Stefano Bruni
Neuroradiologo Interventista
Ospedali Riuniti di Ancona

Cerebral angiography was developed by Portuguese phisician Egas Moniz at the University of Lisbon, in order to identify central nervous system diseases such as tumors or arteriovenous malformations. He performed the first brain angiography in Lisbon in 1927[3] by injecting an iodinated contrast medium into the internal carotid artery and using the X-rays discovered 30 years earlier by Roentgen in order to visualize the cerebral vessels. In pre-CT and pre-MRI, it was the only tool to observe the structures within the skull and was also used to diagnose extravascular pathologies.

Subsequently, European radiologists further developed the angiographic technique by replacing the traumatic direct puncture with catheterization: in 1953, Swedish physician Sven Seldinger introduced the technique of arterial and venous catheterization still in practice,[4] dubbed the Seldinger Technique.

In 1964, the Norwegian radiologist Per Amudsen was the first to perform a complete brain angiography with a transfemoral approach, as it is performed today; he then moved to San Francisco to teach the technique to American neuroradiologists.[5] These two stages, at the basis of modern invasive vascular diagnostics, prepared the way for later therapeutic developments

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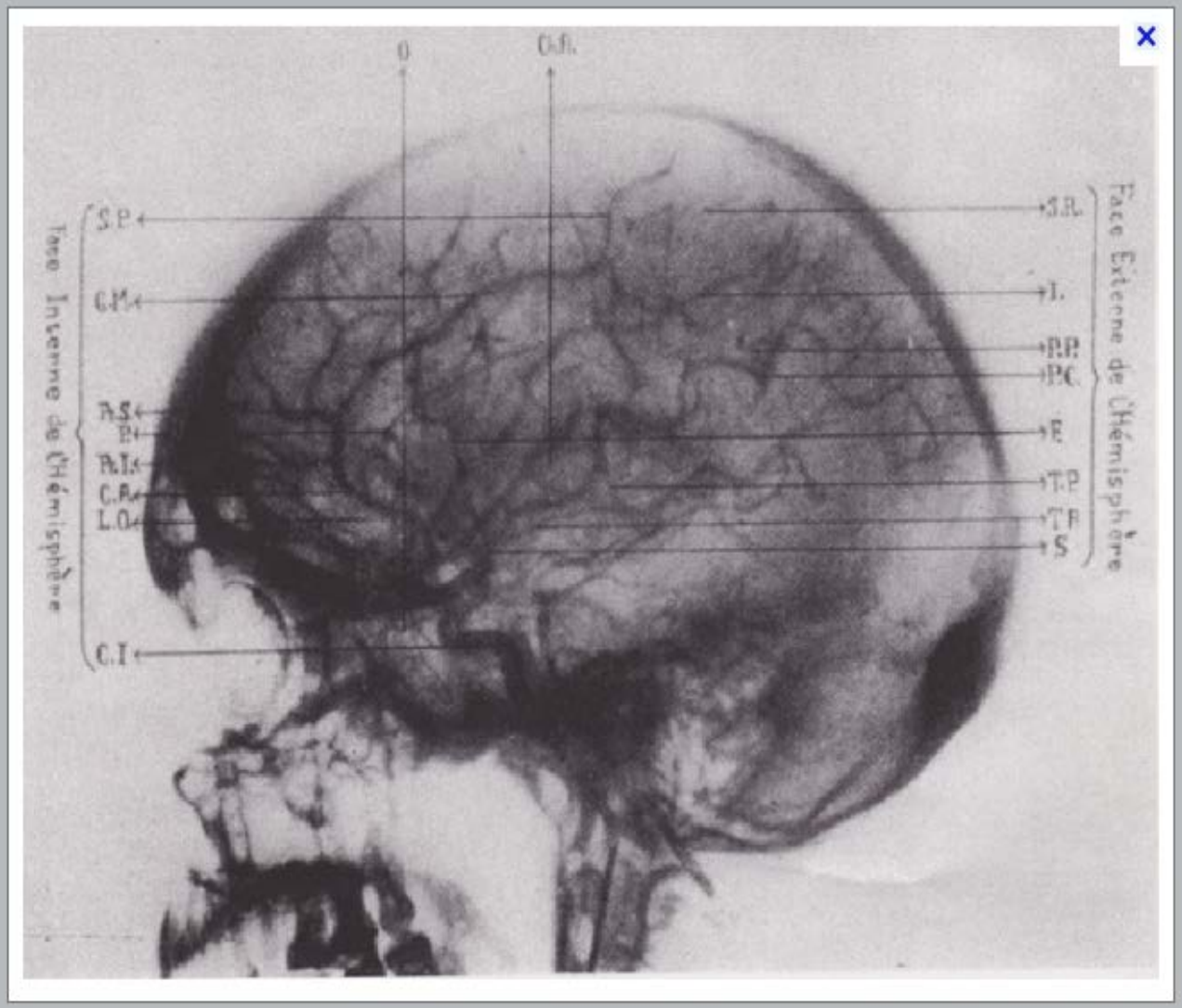


1983

1. Zeumer H, Hacke W, Ringelstein EB, **Local intraarterial thrombolysis in vertebrobasilar thromboembolic disease.** *AJNR Am J Neuroradiol* 1983;4:401-404 [PubMed] [Google Scholar]

Hermann Zeumer

University Hospital Eppendorf Hamburg · Diagnostic and interventional Neuroradiology
Prof.em.Dr.med

1216

Intra-arterial Thrombolytic Therapy Improves Outcome in Patients With Acute Vertebrobasilar Occlusive Disease

Werner Hacke, MD, Hermann Zeumer, MD, Andreas Ferbert, MD, Hartmut Brückmann, MD, and Gregory J. del Zoppo, MD

In this retrospective analysis we report our treatment experience in 65 consecutive patients with clinical signs of severe brainstem ischemia with angiographically demonstrated thrombotic vertebrobasilar artery occlusions who received either local intra-arterial thrombolytic therapy (urokinase or streptokinase) (43 patients) or conventional therapy (antiplatelet agents or anticoagulants) (22 patients). We analyzed the data with respect to cerebral artery occlusion patterns, posttreatment arterial recanalization, and the clinical categories of favorable/unfavorable outcome and survival/death. In subgroup analyses, recanalization in patients who received thrombolytic therapy correlated significantly with clinical outcome; in 19 of 43 patients, recanalization was demonstrated angiographically, while in 24 patients the occlusion persisted. All patients without recanalization died, but 14 of the 19 patients displaying recanalization survived ($p = 0.000007$), 10 with a favorable clinical outcome. Only three of the 22 patients who received conventional therapy survived, all with a moderate clinical deficit. When we compared the treatment groups, highly significant differences in both outcome quality ($p = 0.017$) and survival ($p = 0.0005$) were found to depend on establishing recanalization. Our data support the concept that technically successful thrombolysis of vertebrobasilar artery occlusions is associated with beneficial clinical outcome. (*Stroke* 1988;19:1216–1222)

The prognosis of most patients with acute multiterritorial, life-threatening brainstem syndromes and angiographically proven vertebrobasilar (VB) artery occlusions is poor.[1–11] The term multiterritorial syndrome (or alternans plus syndrome)[12] refers to clinical ischemic symptoms VB artery territory.[8,11–13] Coma, "locked-in" syndrome, multilevel ocular motor disturbances, and bilateral motor deficits represent involvement of more than one ventral perforating artery at different brainstem levels.[8,12–16]

Although no prospective, controlled data exist on

2006-2007
in Italia si eseguono le prime trombectomie

Time is Brain

L'outcome peggiora del 10% per ogni 30 minuti di ritardo per la ricanalizzazione

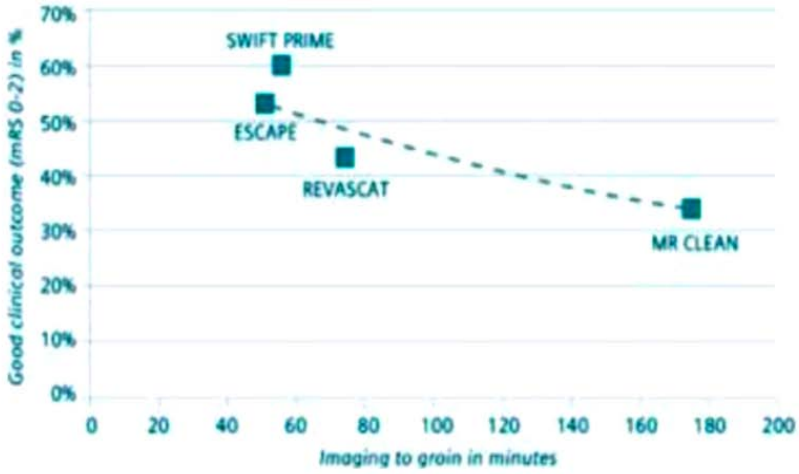
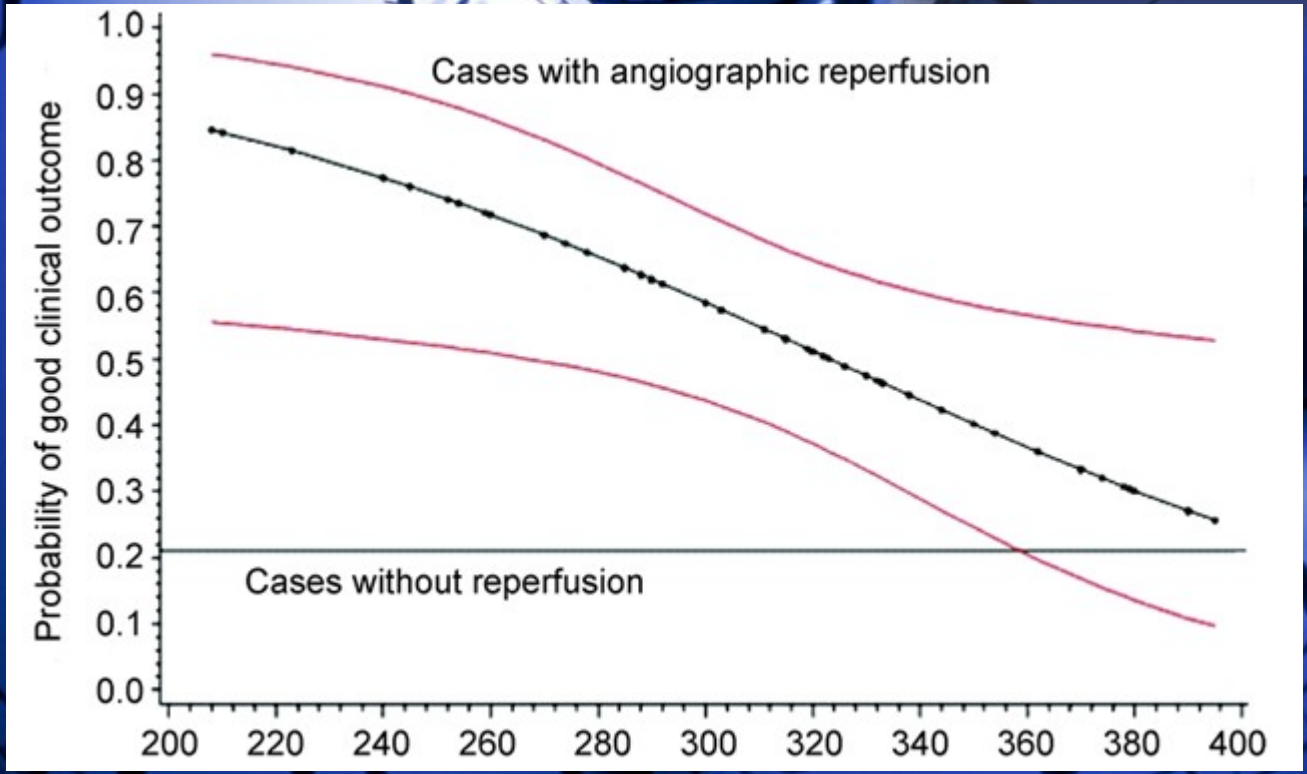
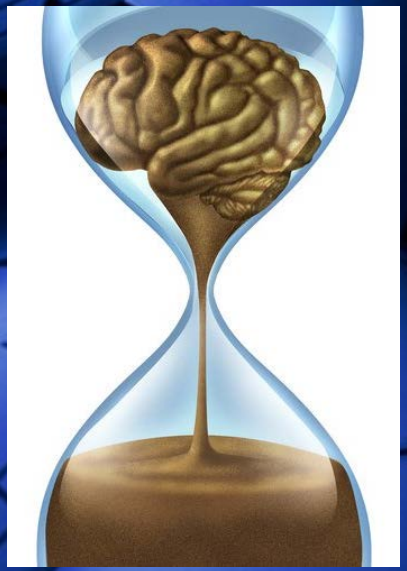
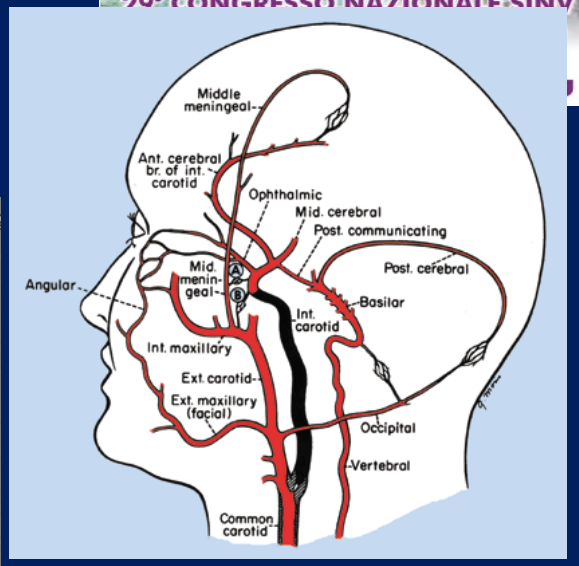


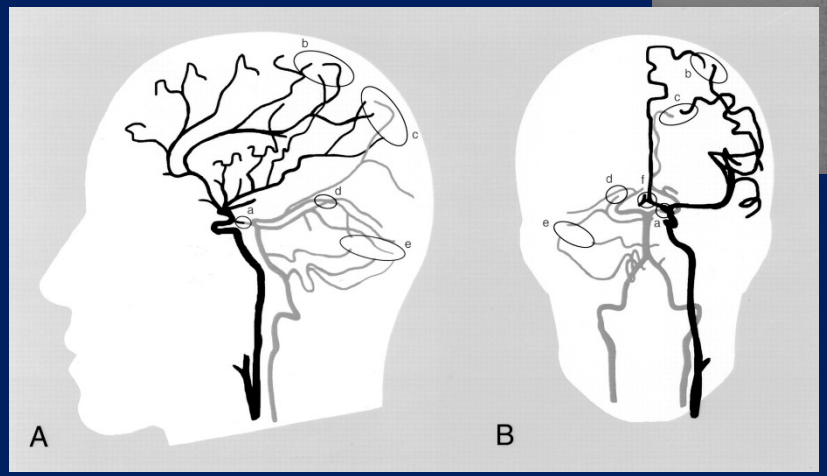
Figure 3: Faster access to endovascular treatment associated with better outcomes





Circoli collaterali



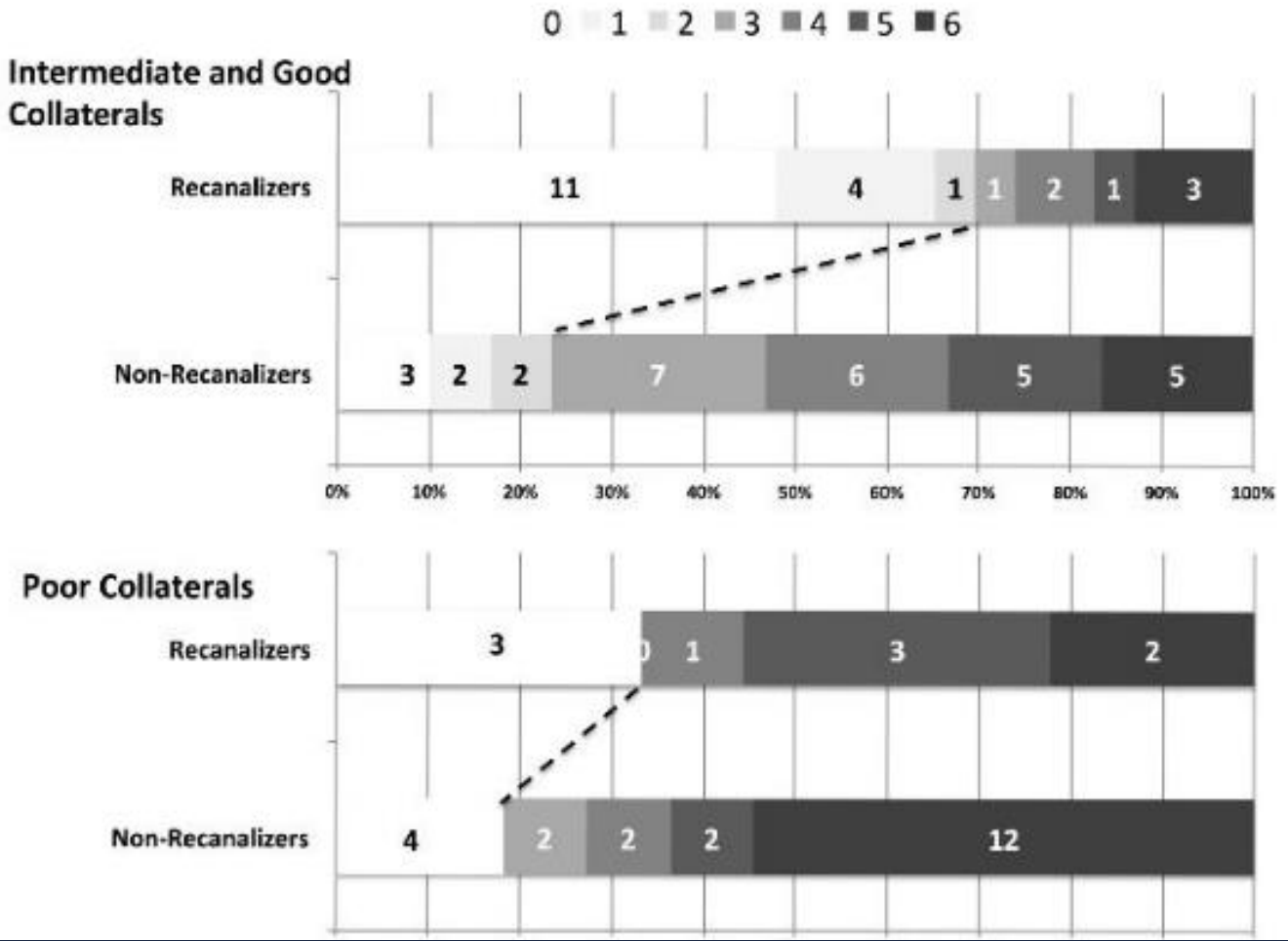


CTA Collateral Status and Response to Recanalization in Patients with Acute Ischemic Stroke

V. Nambiar, S.I. Sohn, M.A. Almekhlafi, H.W. Chang, S. Mishra, E. Qazi, M. Eesa, A.M. Demchuk, M. Goyal, M.D. Hill, and B.K. Menon

CONCLUSIONS: Patients with good or intermediate collaterals on CTA benefit from intra-arterial therapy, whereas patients with poor collaterals do not benefit from treatment.

AJNR2014



rt-PA

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Stroke

ORIGINAL CONTRIBUTIONS;CLINICAL SCIENCES

Low Rates of Acute Recanalization With Intravenous Recombinant Tissue Plasminogen Activator in Ischemic Stroke

Real-World Experience and a Call for Action

Rohit Bhatia, Michael D. Hill, Nandavar Shobha, Bijoy Menon, Simerpreet Bal, Puneet Kochar, Tim Watson, Mayank Goyal, Andrew M. Demchuk

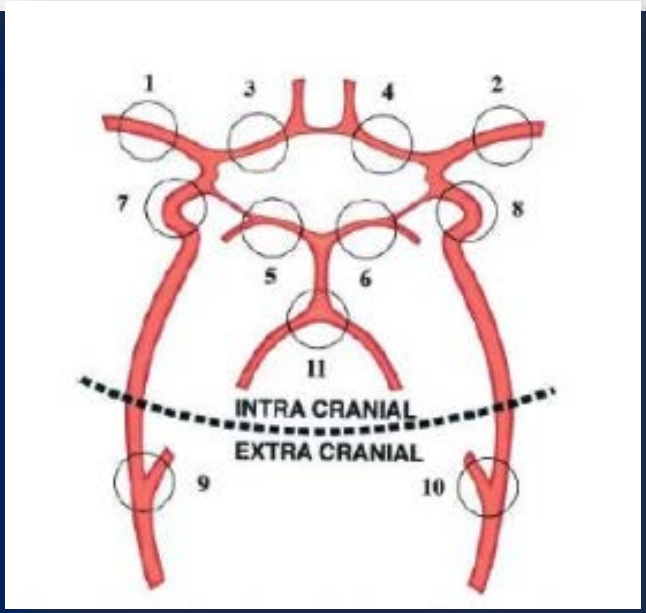

Table 2. Baseline Occlusions and Proportional Recanalization

Occlusion Location	Recanalization (All)	Recanalization After IV rt-PA	Recanalization After Endovascular Treatment	No Recanalization
M1-MCA	75.4% (49)	32.3% (21)	43.1% (28)	24.6% (16)
ICA terminus (T, L) occlusion	43.5% (10)	4.4% (1)	39.1% (9)	56.5% (13)
M2-MCA	92.3% (12)	30.8% (4)	61.5% (8)	7.7% (1)
BA	56.0% (14)	4.0% (1)	52.0% (13)	44.0% (11)
All	67.7% (86)	21.3% (27)	46.5% (59)	32.3% (41)

BA indicates basilar artery; ICA, internal carotid artery; IV, intravenous; MCA, middle cerebral artery; rt-PA, recombinant tissue plasminogen activator.


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Finestra terapeutica entro 3-4.5 h
FIBRINOLISI SEQUENZIALE

In caso di mancata risposta alla terapia ev per "occlusioni maggiori"
viene attivata la sala agf
(reperibilità interventistica h24) e si procede per l' Intervento endovascolare
(termine di intervento entro 6 ore dall'esordio)

Drip and ship

tPA IV :0.9mg/kg

Rescue

AMCD (Trombectomia)

tPA IV :0.6 mg/kg

Bridging

Protocollo Karolinska

In caso di Occlusioni maggiori
(CTA e defict perfusionale con mismatch positvo)
la trombectomia deve essere effettuata quanto prima
(anche con fibrinolitico Ev ancora non termianto)

- Consultare le immagini nel tempo più veloce possibile.
- Teleradiologia (whatsapp, smartphone, tablet, pc, teleconsulto,email)
- Se il paziente viene centralizzato bisogna organizzare un trasporto il più veloce possibile anche senza il referto nè CD.

- Consultare le immagini nel tempo più veloce possibile.
- Teleradiologia (whatsapp, smartphone, tablet, pc, teleconsulto,email)
- Se il paziente viene centralizzato bisogna organizzare un trasporto il più veloce possibile anche senza il referto nè CD.

- Consultare le immagini nel tempo più veloce possibile.
- Teleradiologia (whatsapp, smartphone, tablet, pc, teleconsulto,email,intelligenza artificiale)
- Se il paziente viene centralizzato bisogna organizzare un trasporto il più veloce possibile.

- Durante il trasporto il paziente deve avere una pressione arteriosa sistolica non inferiore a 150-160 mmhg.

Ospedali Riuniti di Ancona

- Radiologia spoke
- Neurologo degli ospedali spoke
- Medico di PS
- Anestesista e Rianimatore
- Neurologo dell'hub
- Neuroradiologia
- Neuroradiologo interventista
- Terapia intensiva
- Neurologia /Stroke unit
- Medicina d'urgenza
- Neurochirurgia
- Medicina fisica e riabilitativa

Improving Door to Groin Puncture Time for Mechanical Thrombectomy via Iterative Quality Protocol Interventions

Vincent J. Cheung [1], Arvin R. Wali [1], David R. Santiago-Dieppa [1], Robert C. Rennert [1], Michael G. Brandel [1], Jeffrey A. Steinberg [1], Brian R. Hirshman [1], Kevin Porras [1], Peter Abraham [1], Julie Jurf [1], Emily Botts [1], Scott Olson [1], J. Scott Pannell [1], Alexander A. Khalessi [1]

1. Department of Neurosurgery, University of California, San Diego

- TC + Angio TC + perfusione
- RM (if possible)
- Fast RTPA
- No CD
- Direct Angiografic room

Steps to achieve faster imaging-to-reperfusion times:

- Measure efficiency: The most important thing you can implement to drastically reduce your time to reperfusion in the hospital is to start measuring. This creates a culture of timeliness and it puts you under pressure to do better and create metrics.
- Engage emergency service providers and emergency department physicians: pre hospital large vessel occlusion (LVO) scales by EMS providers and NIHSS by emergency department physicians.
- IR team: Activate the interventional radiology (IR) team as early as possible based on clinical and plain CT data (NIHSS >10 and ASPECTS >6).
- Imaging: You should minimise imaging to the minimum necessary. At the end of the day, what imaging does is excludes patients, it picks the raisins, it does not get more patients treated.
- Consent: Get started with the consent right away, if the patient does not qualify, it is ok if you do not do the procedure.
- Anaesthesia/intubation: We avoid anaesthesia and intubation at our institution as it slows down the procedure. I do not believe there are safety issues related to not using anaesthesia.
- Minimise transport steps: We need to redesign these acute stroke endovascular centres to be close to or integrated with CT scanners.

Source: Tudor Jovin (LINNC; 24 June 2015, Paris, France)

Arrivo nella sala angiografica

- Tecnico di Neuroradiologia (TSRM)
- Infermiere della Neuroradiologia
- Anestesista e Rianimatore
- Neuroradiologo Interventista

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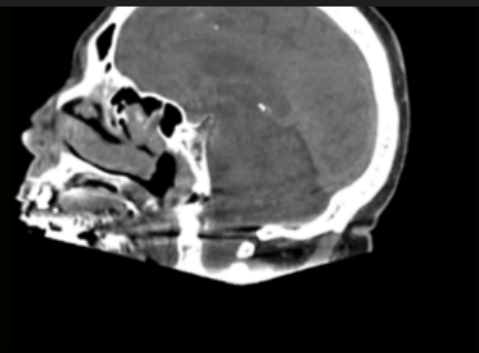
Thrombectomy in stroke using *syngo* DynaCT Sine Spin

Neuro Interventions



Case Description

Patient history
83-year-old male patient

Diagnosis
CTA in another hospital showed an acute occlusion of the left MCA (middle cerebral artery) in the M1 segment.

Treatment
Intracranial thrombectomy with stent retriever under general anesthesia. Thrombectomy in several maneuvers with Solitaire X stent retriever and Tigertriever to reopen the vessel.

General Comments:
Upon arrival of the patient in our department from the other hospital, the initial CT was 3h old. With a native *syngo* DynaCT Sine Spin, we could check for potential bleeding and demarcation of the infarct before starting thrombectomy. The final *syngo* DynaCT Sine Spin showed a blood-brain barrier disorder, which influences the further treatment of the patient. Severe bleeding would have also been visible.

Tips & Tricks:
The correct location of the intubation tube is very important for good image quality. Position the ventilation hose from the mouth towards the foot end.

Courtesy of
Prof. René Chapot, MD; Ekin Celik, MD; Interventional Neuroradiology, Alfried Krupp Hospital, Essen, Germany

Supported by
syngo DynaCT Sine Spin

System & Software
ARTIS icono VE2 with *syngo* Application Software VE2

DSA imaging during intervention

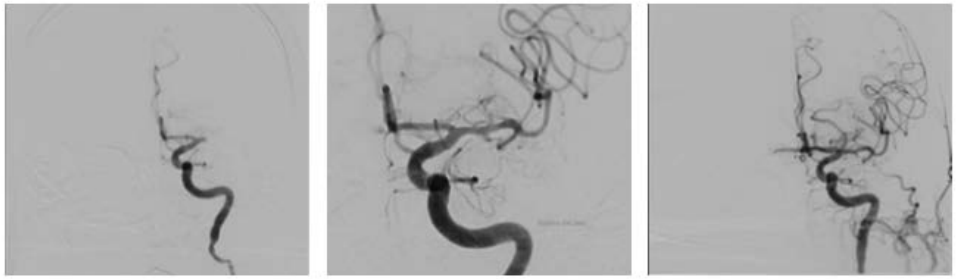


Fig. 2. MCA occlusion

After first pass

Post-interventional *syngo* DynaCT Sine Spin

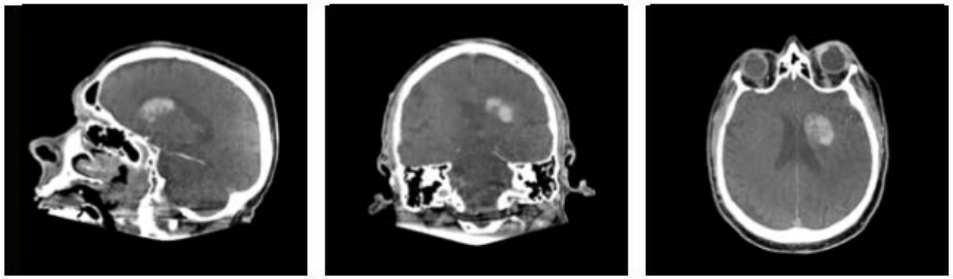


Fig. 3. MPR 0.5 mm contrast medium pooling

TROMBOASPIRAZIONE

Downloaded from http://jnis.bmj.com/ on March 27, 2016 - Published by group.bmj.com

Ischemic stroke

ORIGINAL RESEARCH

ADAPT FAST study: a direct aspiration first pass technique for acute stroke thrombectomy

Aquilla S Turk,[1] Don Frei,[2] David Fiorella,[3] J Mocco,[4] Blaise Baxter,[5] Adnan Siddiqui,[6] Alex Spiotta,[7] Maxim Mokin,[3] Michael Dewan,[8] Steve Quarfordt,[5] Holly Battenhouse,[9] Raymond Turner,[7] Imran Chaudry[1]

For numbered affiliations see end of article.

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Received 16 January 2014
Revised 4 February 2014
Accepted 5 February 2014

ABSTRACT

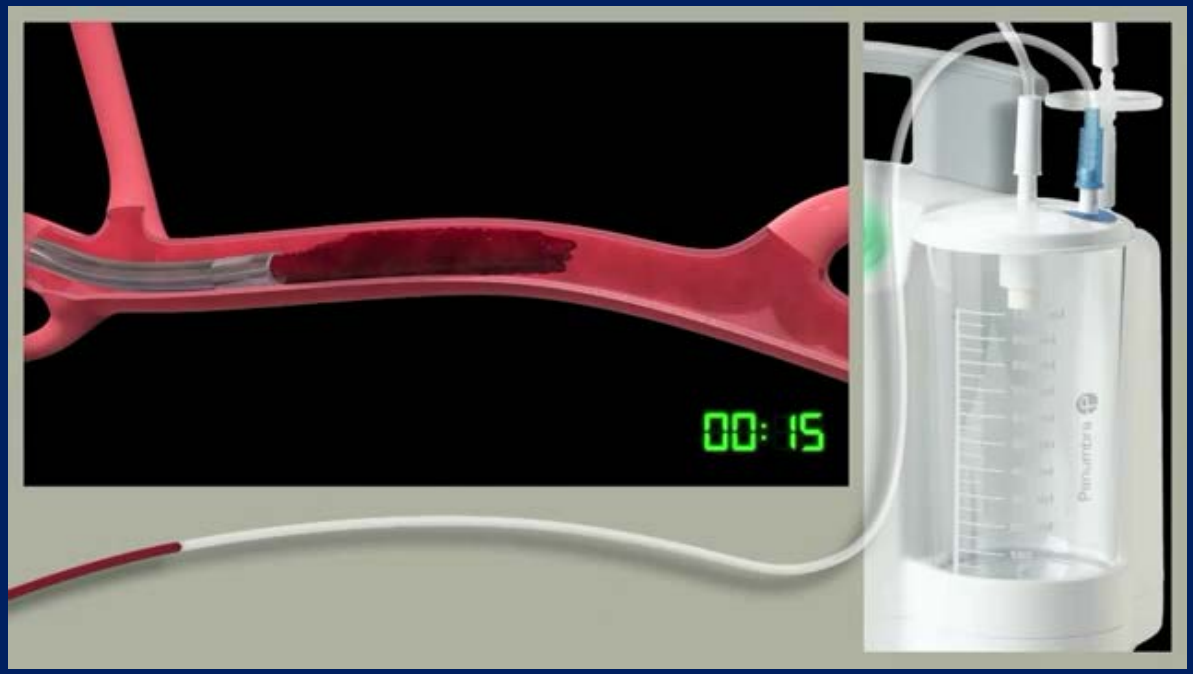
Background The development of new revascularization devices has improved recanalization rates and time, but not clinical outcomes. We report a prospectively collected clinical experience with a new technique utilizing a direct aspiration first pass technique with large bore aspiration catheter as the primary method for vessel recanalization.

Methods 98 prospectively identified acute ischemic stroke patients with 100 occluded large cerebral vessels at six institutions were included in the study. The ADAPT technique was utilized in all patients. Procedural and clinical data were captured for analysis.

large bore aspiration catheters as a first approach for thrombectomy has recently been reported.[7] The purpose of this study was to follow-up the initial experience with a prospective report of all stroke cases that had undergone a direct aspiration first pass technique (ADAPT) with a large bore aspiration catheter as the primary method for vessel recanalization.

METHODS

Under an institutional review board approved

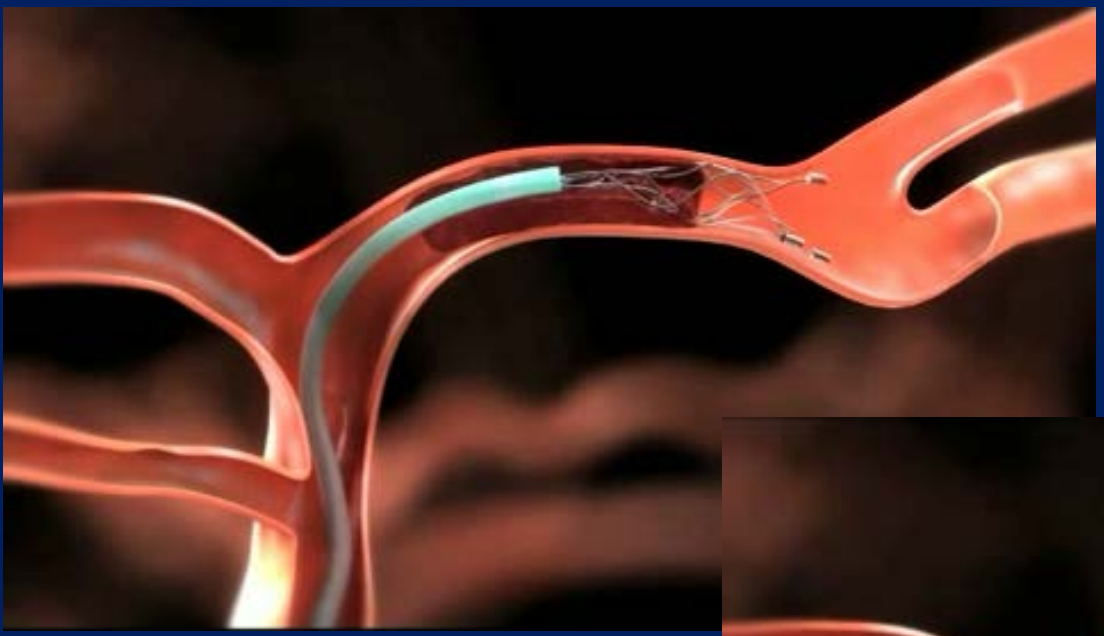


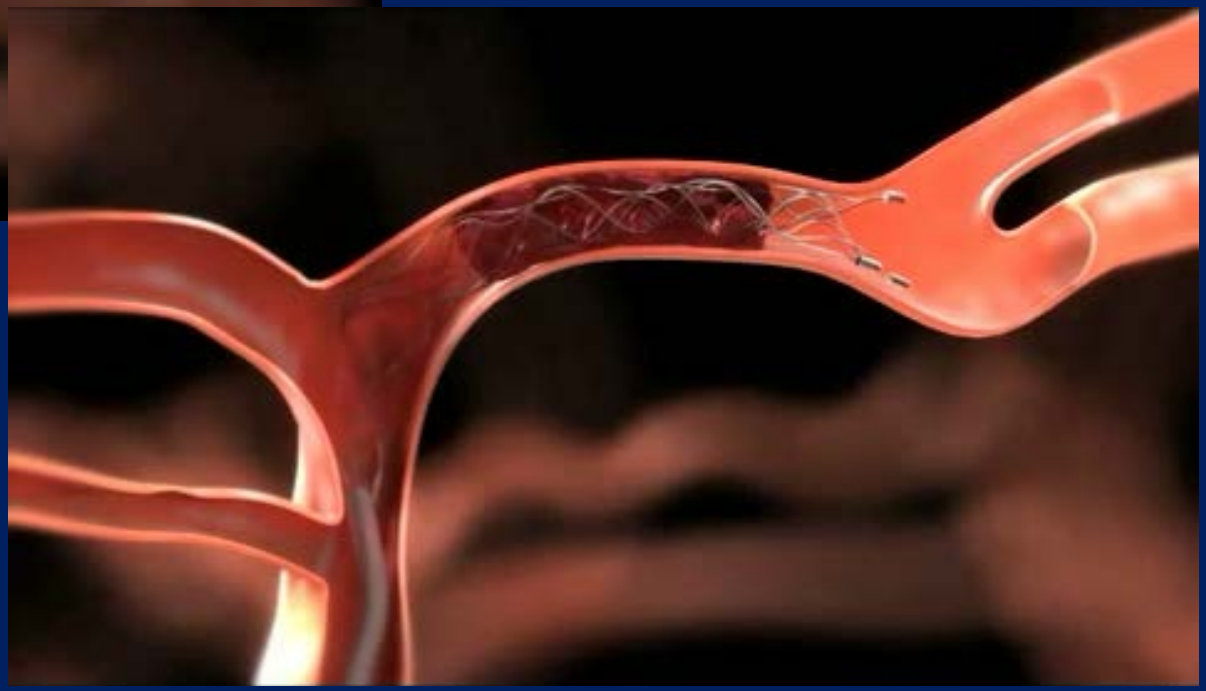
Le trombectomie possono interessare:

Il circolo anteriore (Arteria cerebrale media ed anteriore)

Il circolo posteriore (arteria basilare/vertebrale)

TROMBECTOMIA MECCANICA (stent retriever)





Research

JAMA | Original Investigation

Effect of Endovascular Contact Aspiration vs Stent Retriever on Revascularization in Patients With Acute Ischemic Stroke and Large Vessel Occlusion

The ASTER Randomized Clinical Trial

Bertrand Lapergue, MD, PhD; Raphael Blanc, MD, MSc; Benjamin Gory, MD, PhD; Julien Labreuche, BST; Alain Duhamel, PhD; Gautier Marnat, MD; Suzana Saleme, MD; Vincent Costalat, MD, PhD; Serge Bracard, MD; Hubert Desal, MD, PhD; Mikael Mazighi, MD, PhD; Arturo Consoli, MD; Michel Piotin, MD, PhD; for the ASTER Trial Investigators

Supplemental content

IMPORTANCE The benefits of endovascular revascularization using the contact aspiration technique vs the stent retriever technique in patients with acute ischemic stroke remain uncertain because of lack of evidence from randomized trials.

OBJECTIVE To compare efficacy and adverse events using the contact aspiration technique vs the standard stent retriever technique as a first-line endovascular treatment for successful revascularization among patients with acute ischemic stroke and large vessel occlusion.

DESIGN, SETTING, AND PARTICIPANTS The Contact Aspiration vs Stent Retriever for Successful Revascularization (ASTER) study was a randomized, open-label, blinded end-point clinical trial conducted in 8 comprehensive stroke centers in France (October 2015-October 2016). Patients who presented with acute ischemic stroke and a large vessel occlusion in the anterior circulation within 6 hours of symptom onset were included.

INTERVENTIONS Patients were randomly assigned to first-line contact aspiration (n = 192) or first-line stent retriever (n = 189) immediately prior to mechanical thrombectomy.

MAIN OUTCOMES AND MEASURES The primary outcome was the proportion of patients with successful revascularization defined as a modified Thrombolysis in Cerebral Infarction score of 2b or 3 at the end of all endovascular procedures. Secondary outcomes included degree of disability assessed by overall distribution of the modified Rankin Scale (mRS) score at 90 days, change in National Institutes of Health Stroke Scale (NIHSS) score at 24 hours, all-cause mortality at 90 days, and procedure-related serious adverse events.

RESULTS Among 381 patients randomized (mean age, 69.9 years; 174 women [45.7%]), 363 (95.3%) completed the trial. Median time from symptom onset to arterial puncture was 227 minutes (interquartile range, 180-280 minutes). For the primary outcome, the proportion of patients with successful revascularization was 85.4% (n = 164) in the contact aspiration group vs 83.1% (n = 157) in the stent retriever group (odds ratio, 1.20 [95% CI, 0.68-2.10]; $P = .53$; difference, 2.4% [95% CI, −5.4% to 9.7%]). For the clinical efficacy outcomes (change

ASTER trial 2017

- Rivascolarizzazione (TICI 2b-3):
  85,4% tromboaspirazione
  83,1 stent retriever

- Efficacia (NIHSS score a 24 h e mRS score a 90 gg):
  Nessuna differenza significativa nei due gruppi

CONCLUSIONS AND RELEVANCE Among patients with ischemic stroke in the anterior circulation undergoing thrombectomy, first-line thrombectomy with contact aspiration compared with stent retriever did not result in an increased successful revascularization rate at the end of the procedure.

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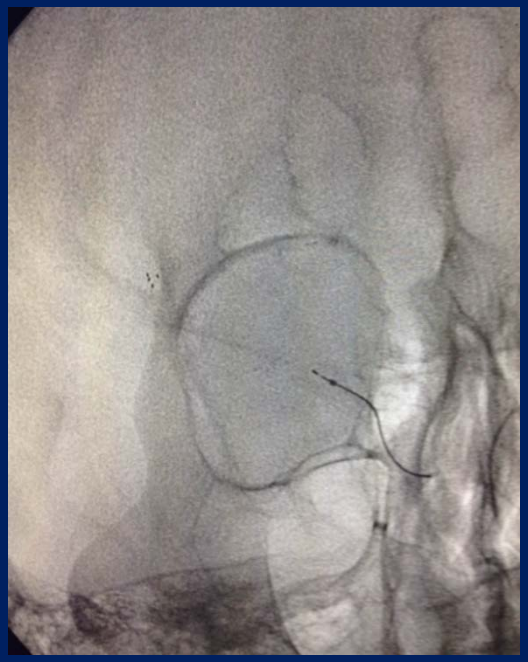
STENT RETRIVER - MEDIA



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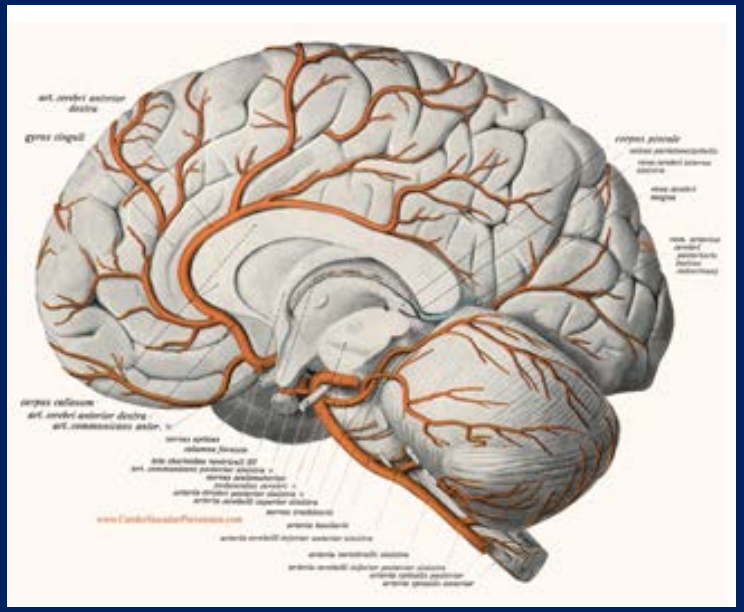
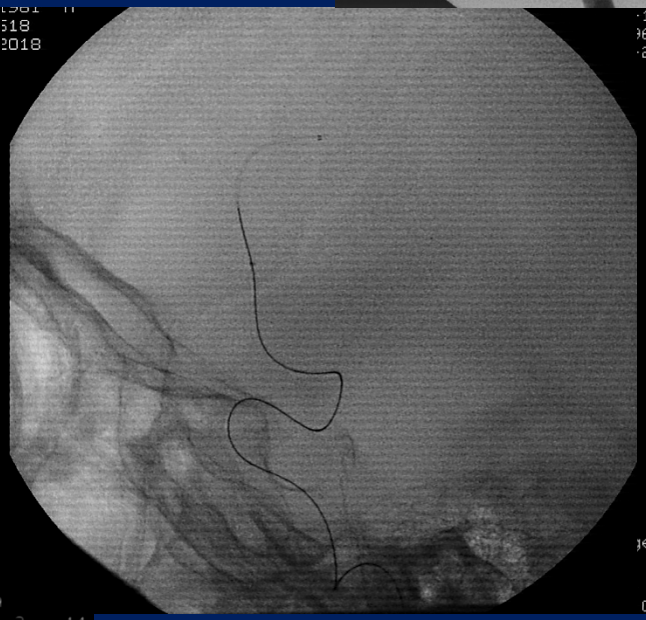
STENT RETRIVER - ANTERIORE



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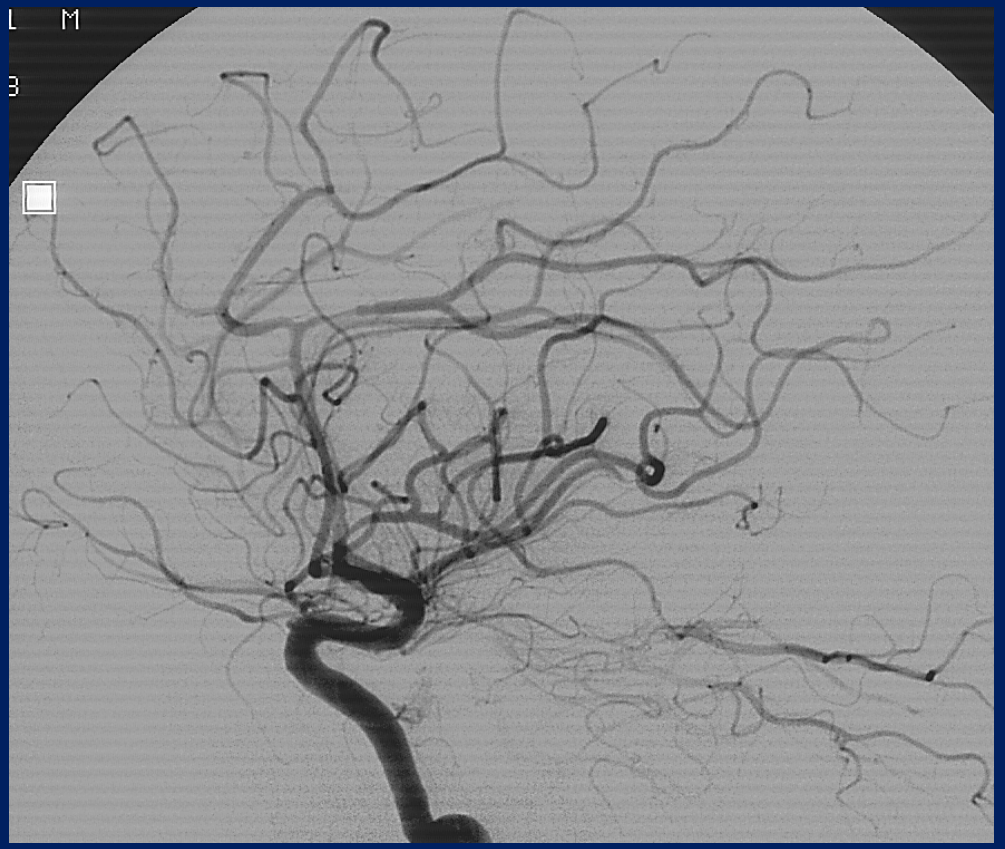


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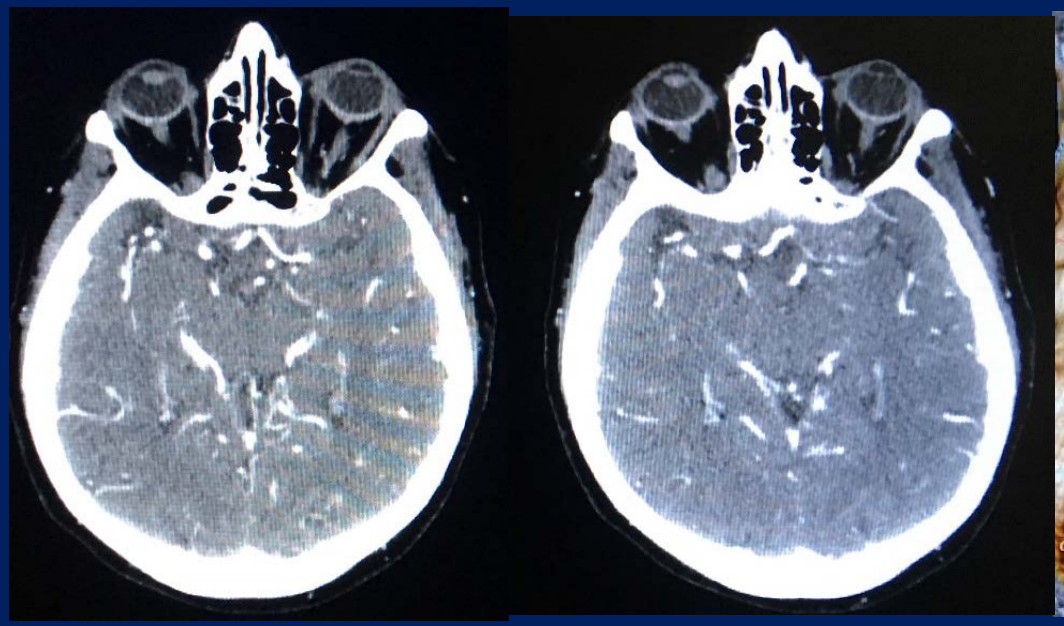

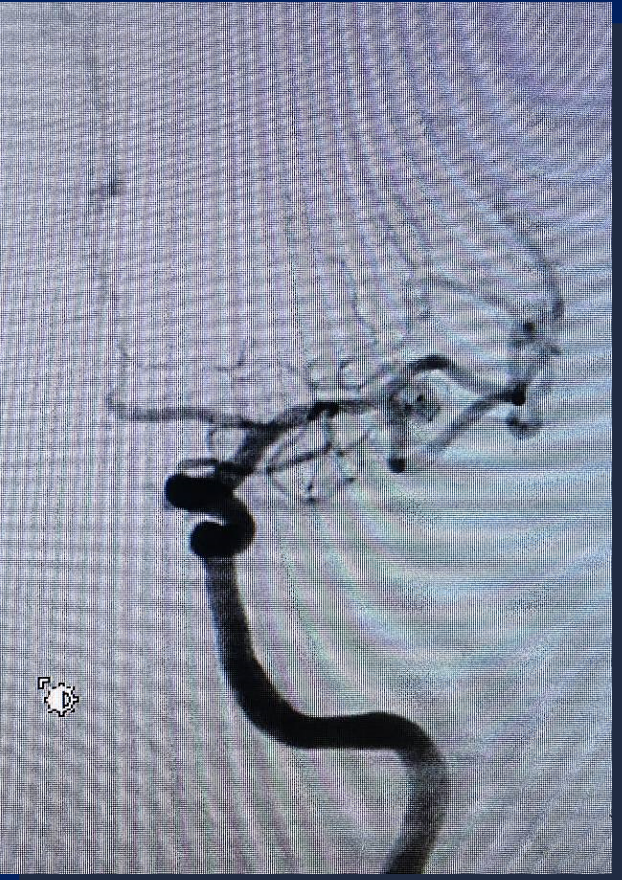

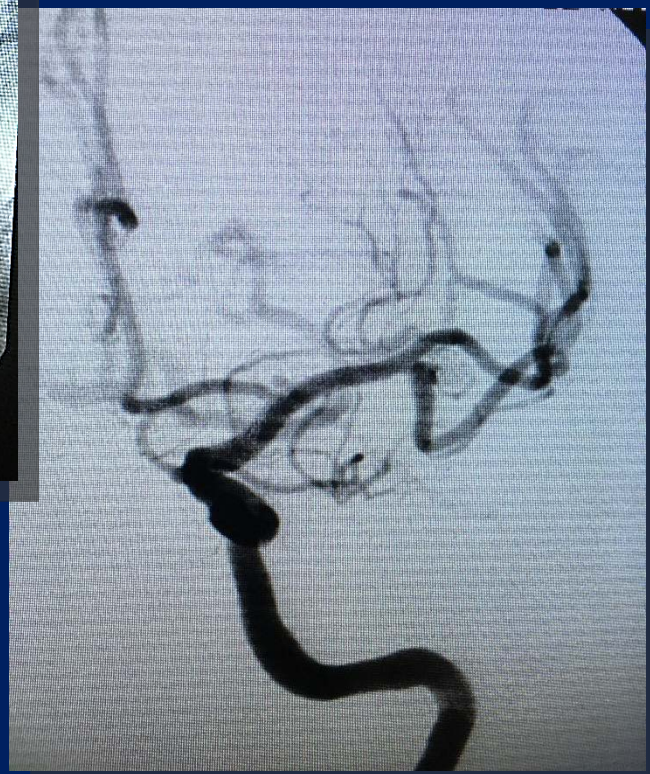


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Limiti della trombectomia

- Cateterismo femorale comune

- In situazioni di stenosi/ occlusioni bilaterali delle arterie femorali comuni o in casi di arco dell'aorta con anatomie complesse o aorta toracica operata si esegue cateterismo omerale/radiale.

Uomo olandese 62 anni

Nihss 18


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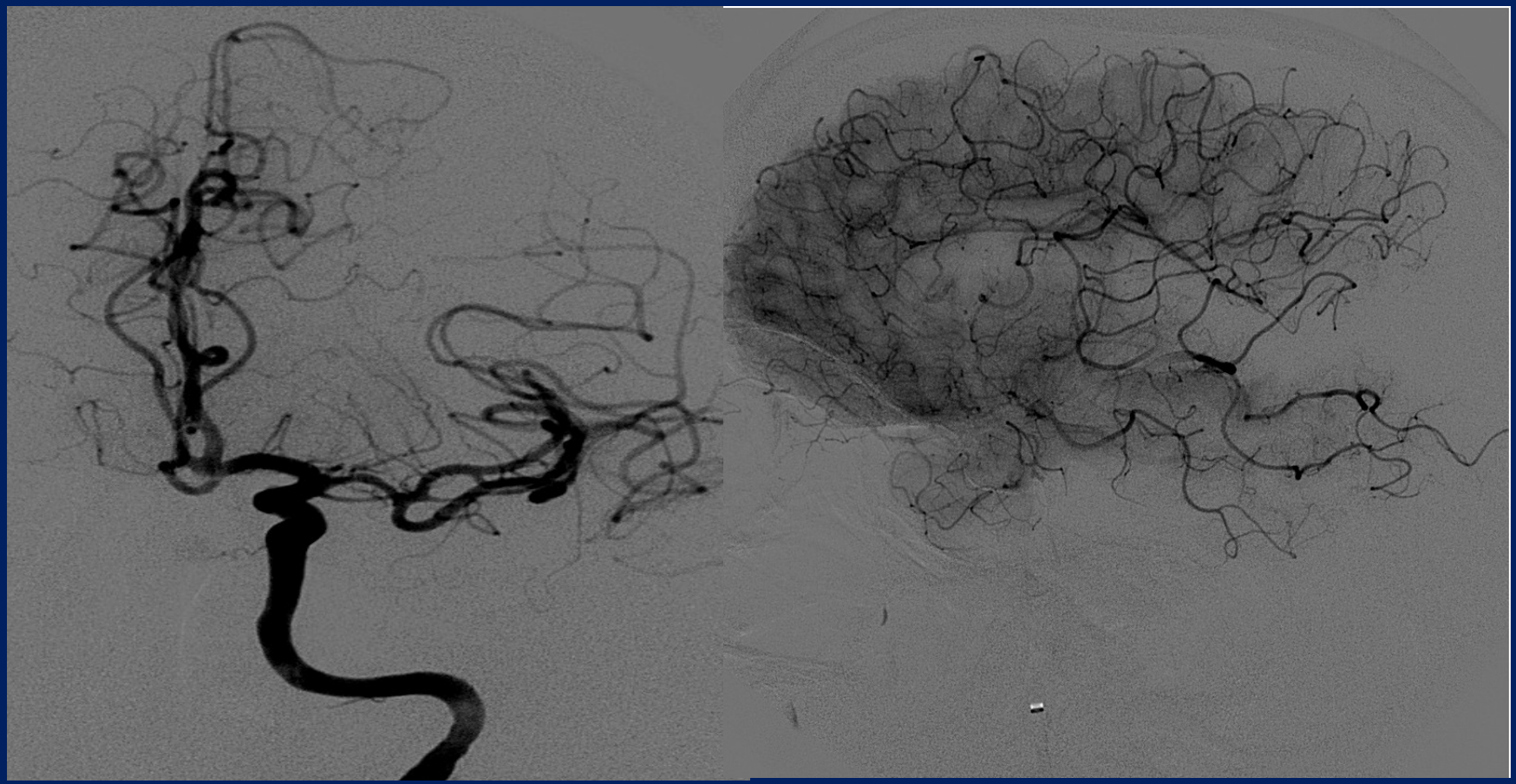

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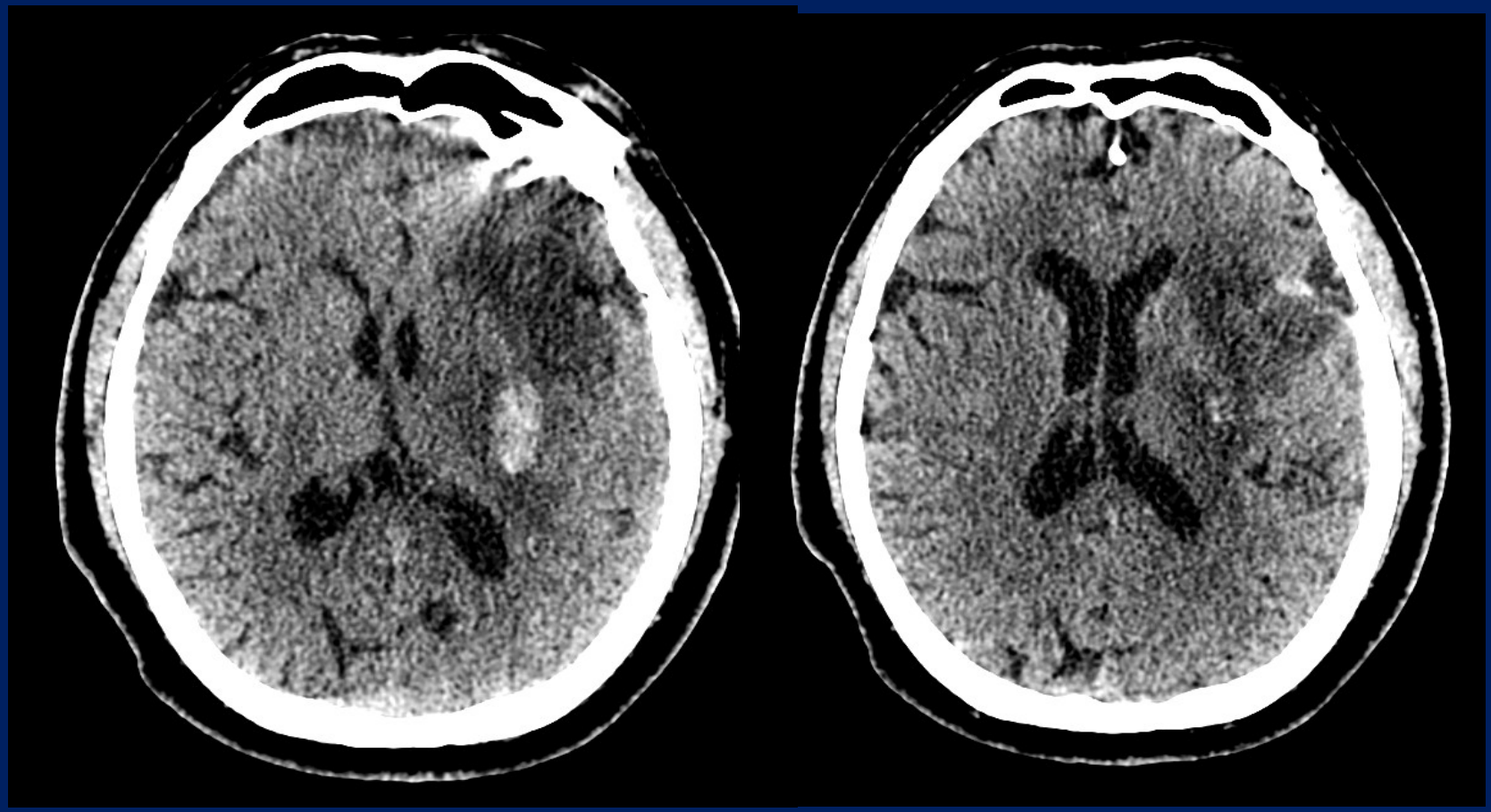

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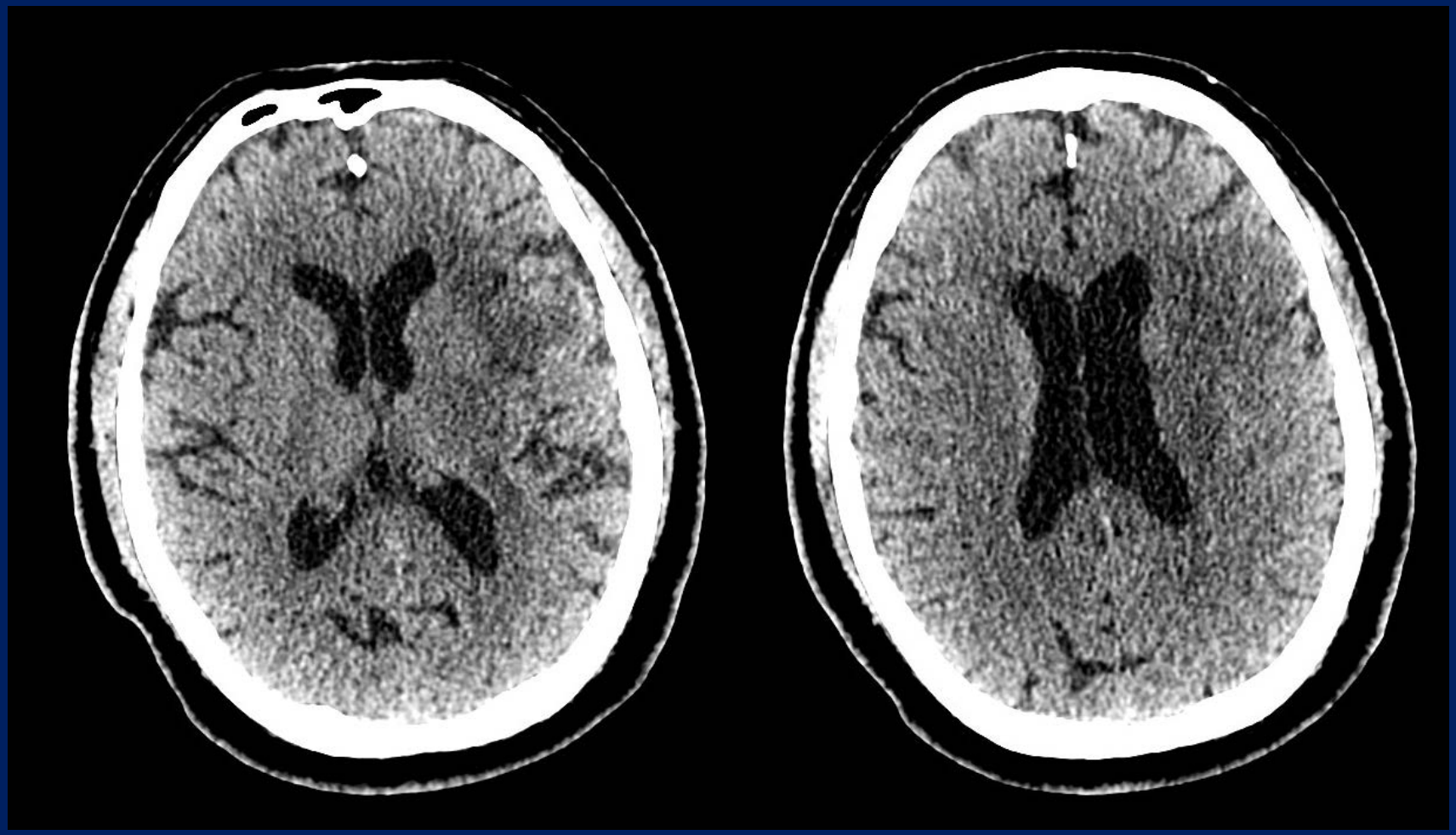

- Uomo 1953
- Iniziale vertigine
- Sopore


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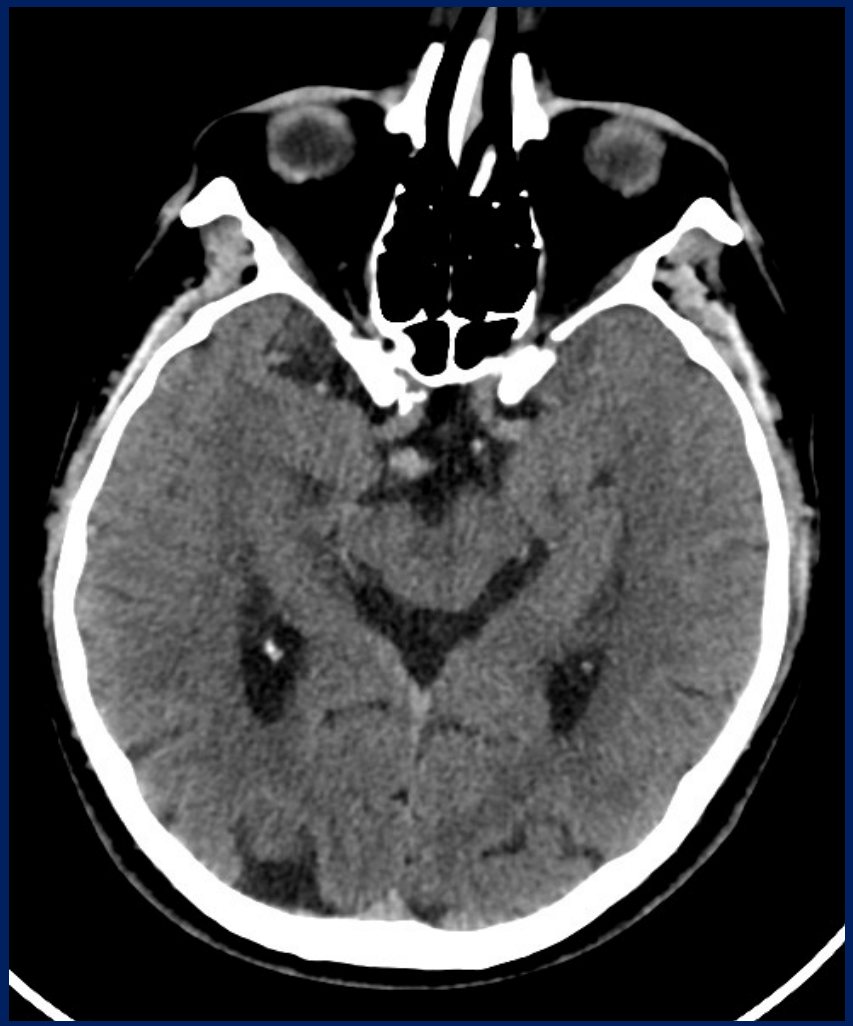
I ALBERTO
1953 M
29938
2022
NEURO RADIOLOGIA
MA

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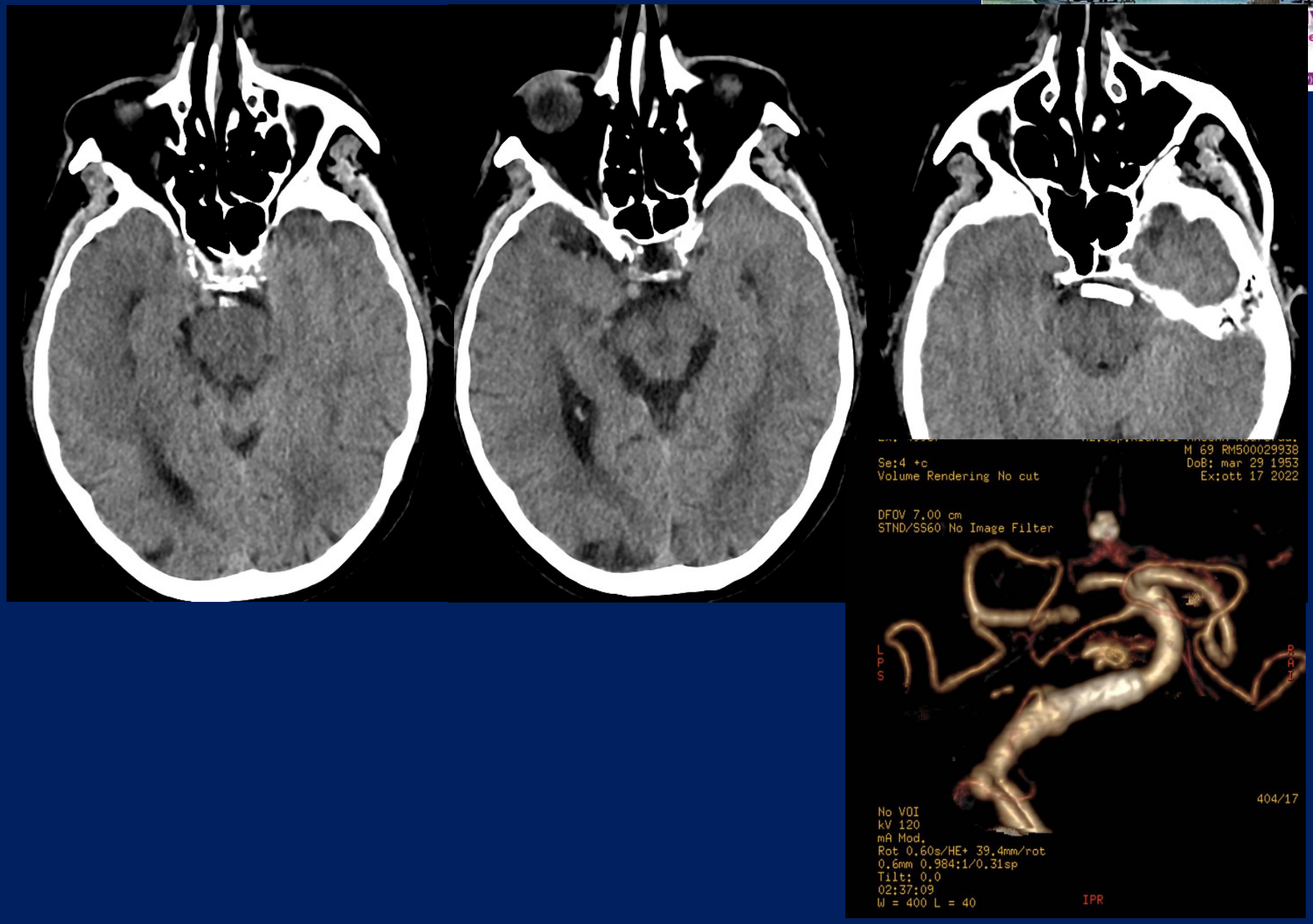
M 69 RM500029938
DoB: mar 29 1953
Ex:ott 17 2022
Se:4 +c
Volume Rendering No cut
DFOV 7.00 cm
STND/SS60 No Image Filter
L
P
S
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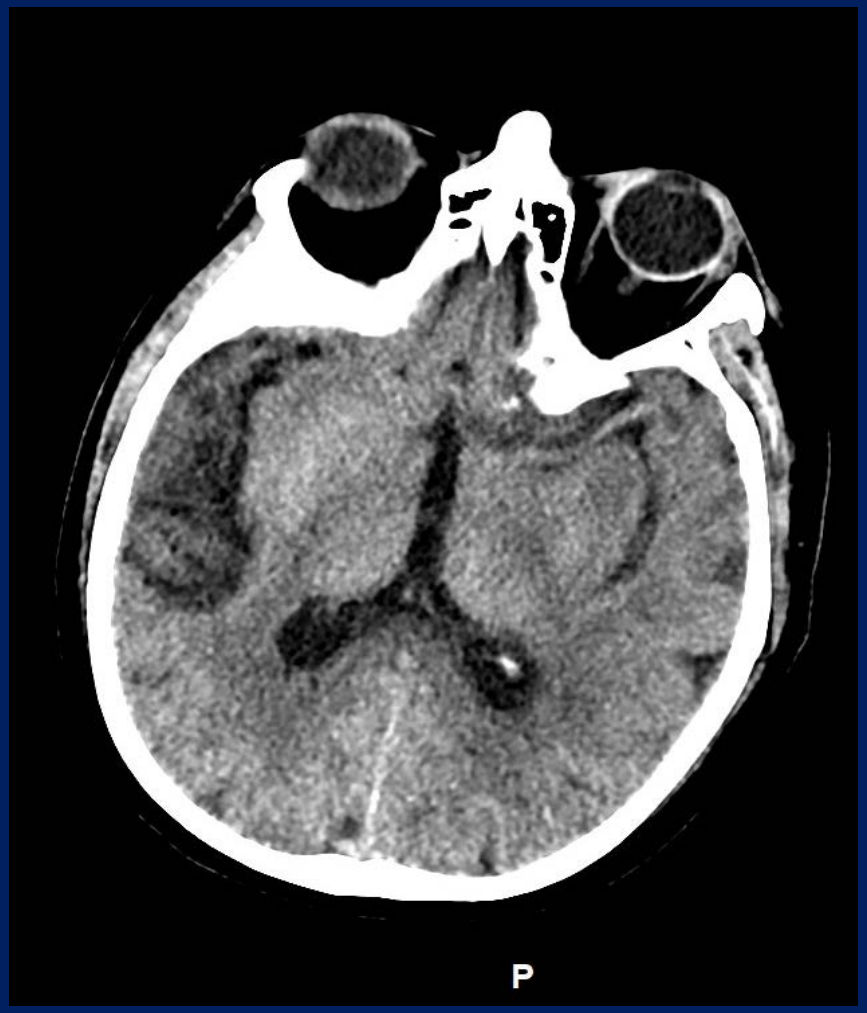
A
I
404/17
No VOI
kV 120
mA Mod.
Rot 0.60s/HE+ 39.4mm/rot
0.6mm 0.984:1/0.31sp
Tilt: 0.0
02:37:09
W = 400 L = 40
IPR

Uomo 1953



Paziente con stroke al Risveglio

Nihss 18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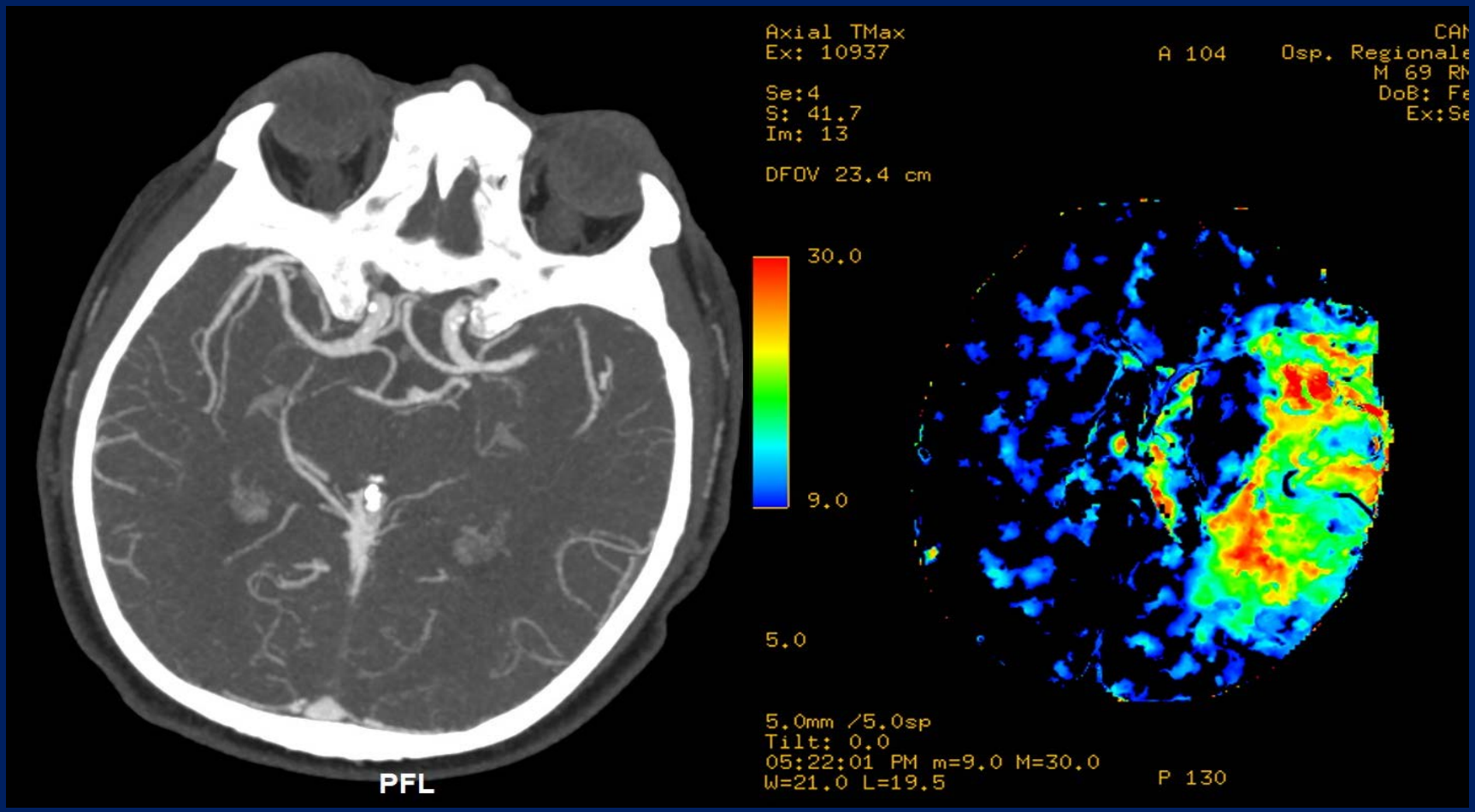
Axial TMax
Ex: 10937
Se:4
S: 41.7
Im: 13
DFOV 23.4 cm
A 104
Osp. Regionale
30.0
9.0
5.0
5.0mm /5.0sp
Tilt: 0.0
05:22:01 PM m=9.0 M=30.0
W=21.0 L=19.5
P 130
PFL


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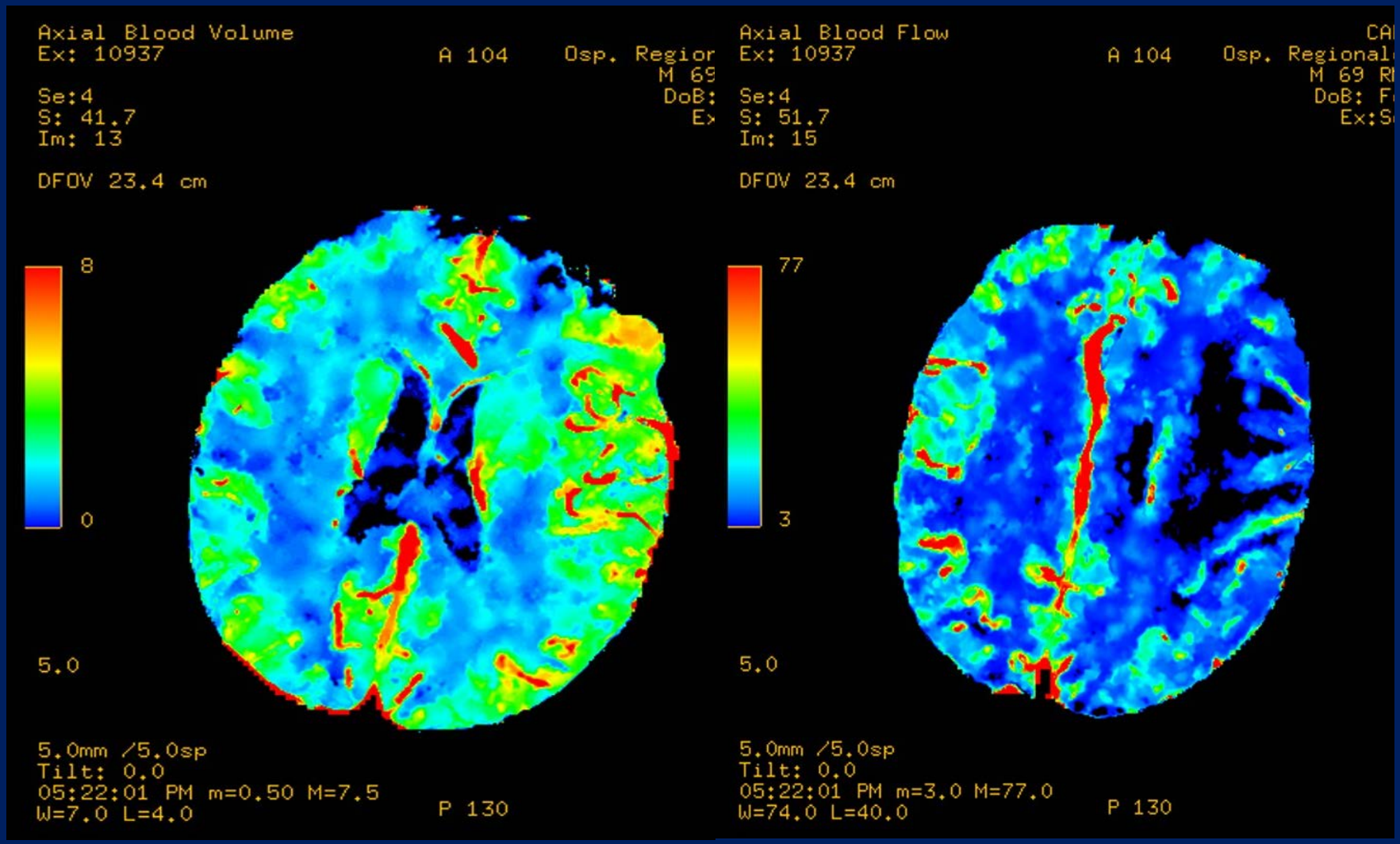
Axial Blood Volume
Ex: 10937
A 104
Osp. Regior
M 69
DoB:
Ex
Se:4
S: 41.7
Im: 13
DFOV 23.4 cm
8
0
5.0
5.0mm /5.0sp
Tilt: 0.0
05:22:01 PM m=0.50 M=7.5
W=7.0 L=4.0
P 130
Axial Blood Flow
Ex: 10937
A 104
Osp. Regional
M 69 R
DoB: F
Ex:S
Se:4
S: 51.7
Im: 15
DFOV 23.4 cm
77
3
5.0
5.0mm /5.0sp
Tilt: 0.0
05:22:01 PM m=3.0 M=77.0
W=74.0 L=40.0
P 130


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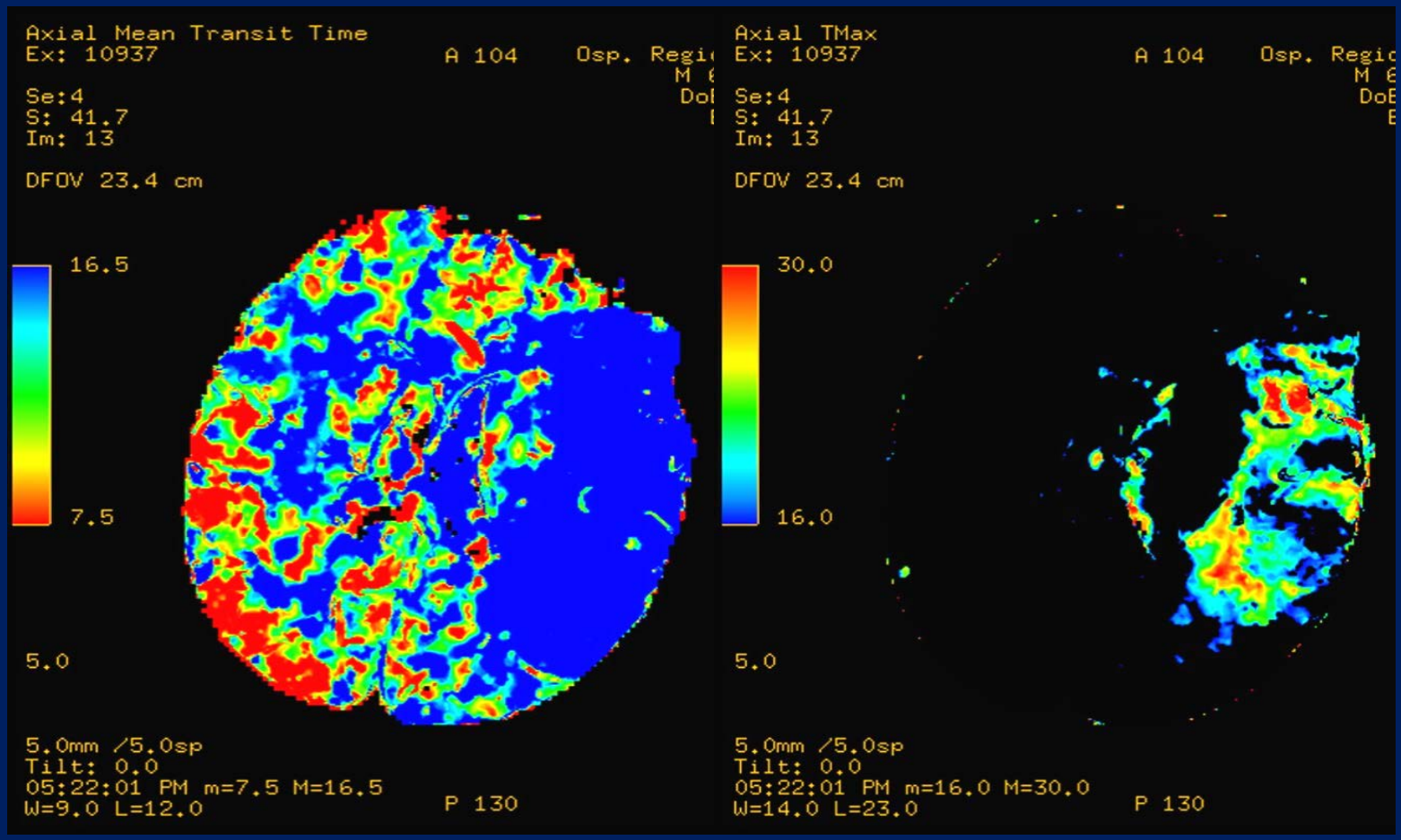
Axial Mean Transit Time
Ex: 10937
A 104
Osp. Regi
Se:4
S: 41.7
Im: 13
DFOV 23.4 cm
16.5
7.5
5.0
5.0mm /5.0sp
Tilt: 0.0
05:22:01 PM m=7.5 M=16.5
W=9.0 L=12.0
P 130
Axial TMax
Ex: 10937
A 104
Osp. Regi
Se:4
S: 41.7
Im: 13
DFOV 23.4 cm
30.0
16.0
5.0
5.0mm /5.0sp
Tilt: 0.0
05:22:01 PM m=16.0 M=30.0
W=14.0 L=23.0
P 130


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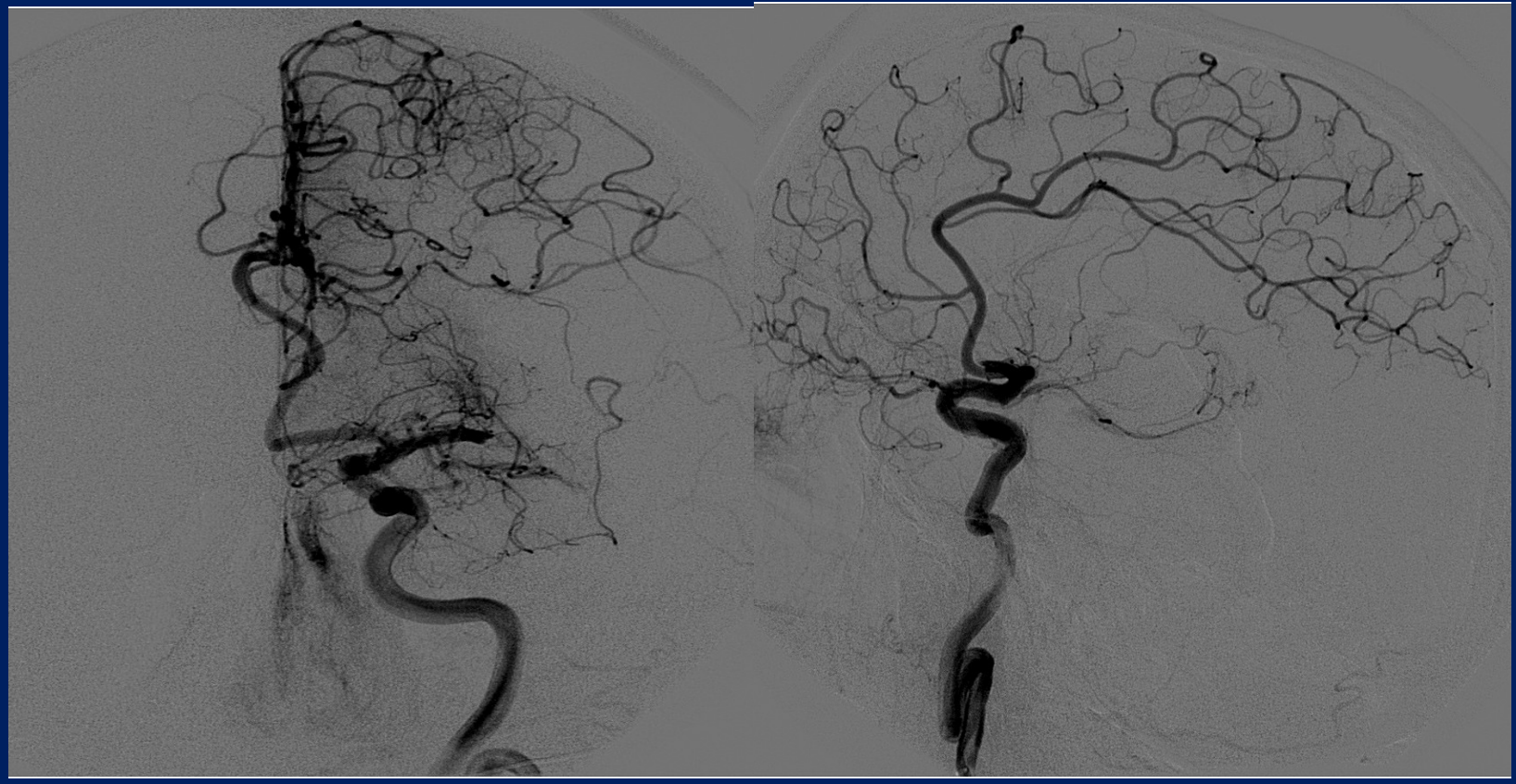


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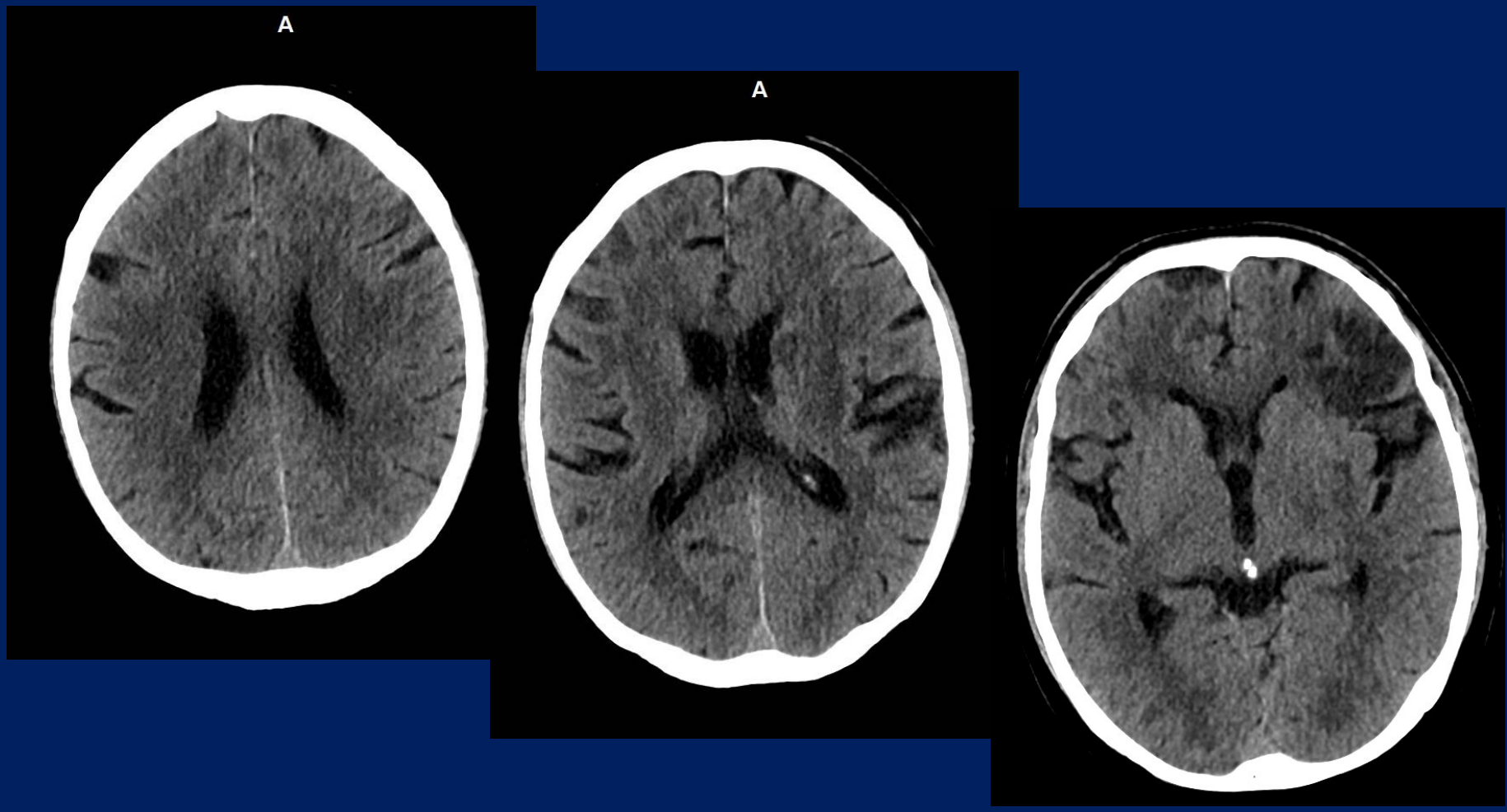
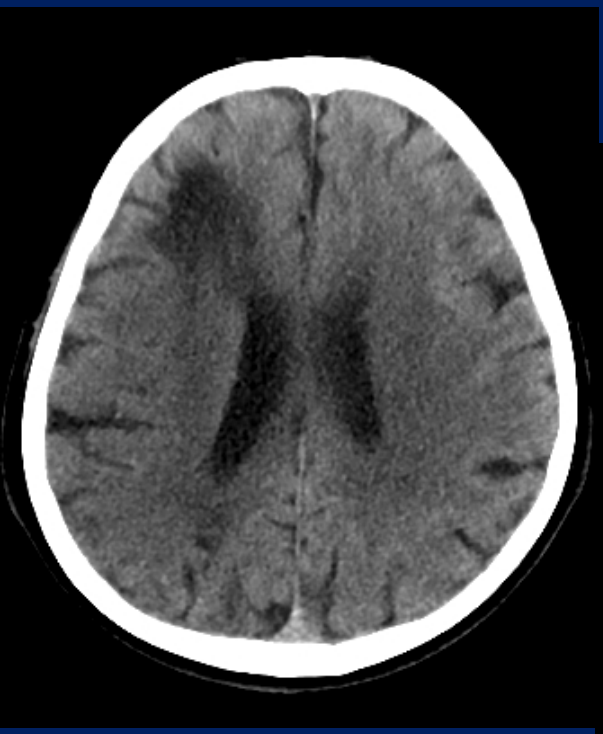
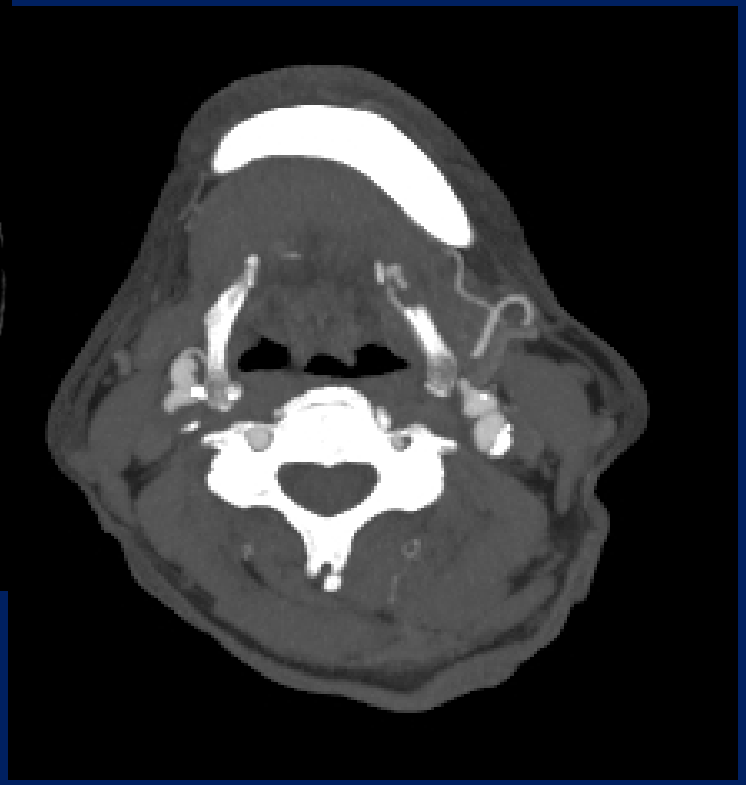

A
A

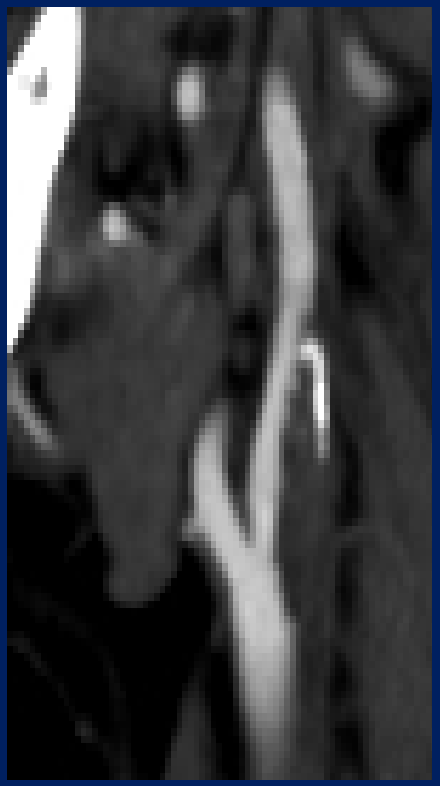
NIHSS 5

Uomo del 1946

- Da alcuni giorni il paziente presenta ipostenia all'arto superiore sinistra, però l'ipostenia talvolta non è più apprezzabile.
- Arriva in ps con Nihss 7





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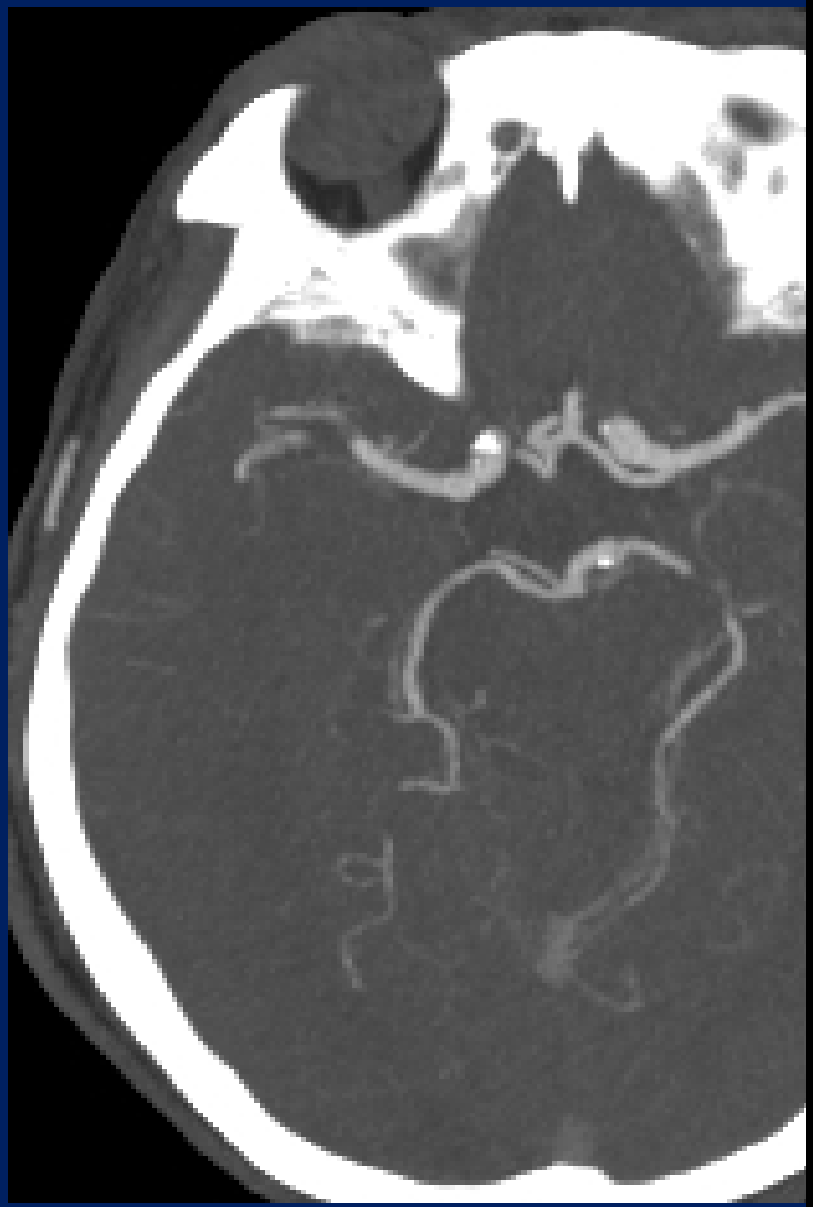
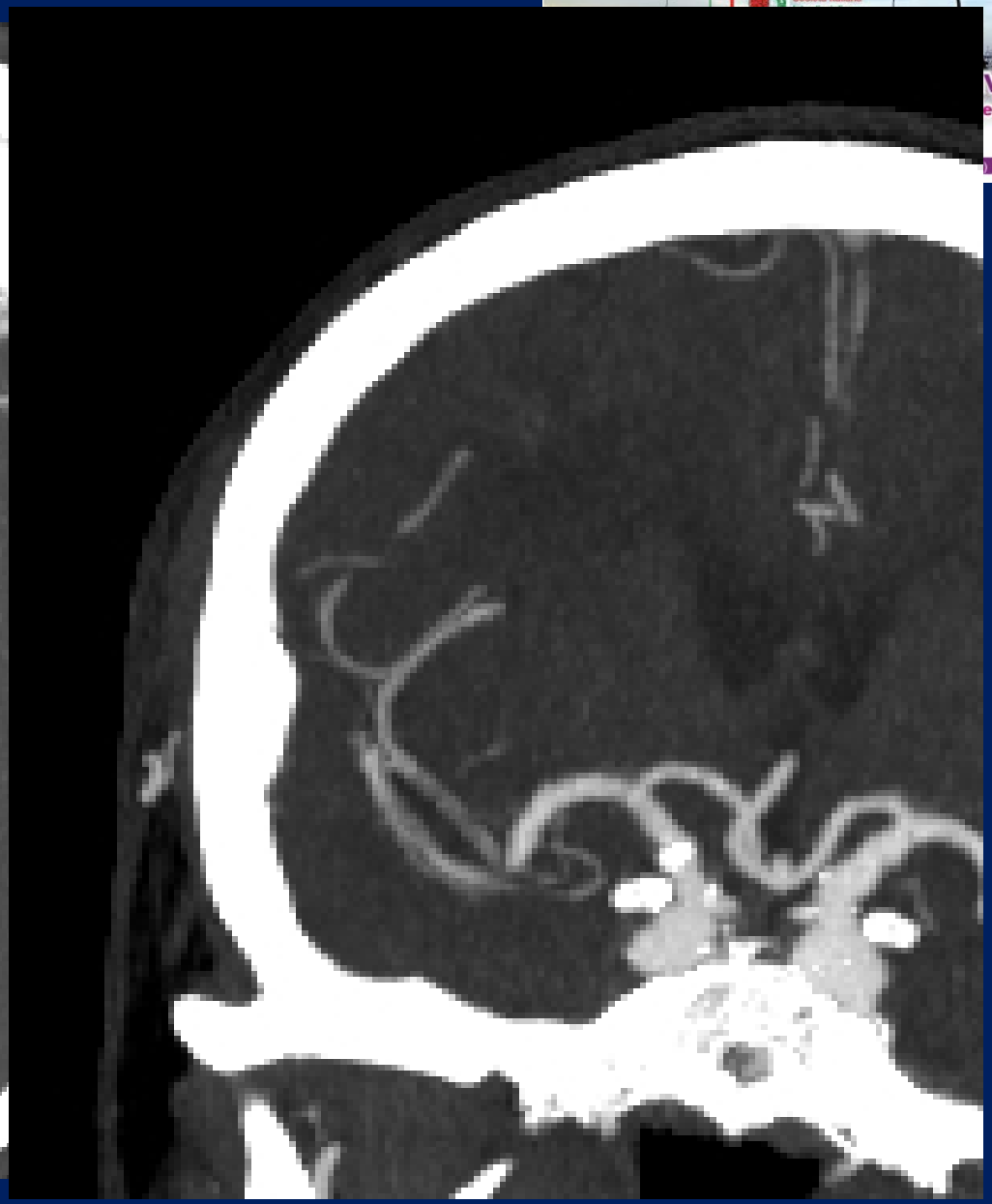
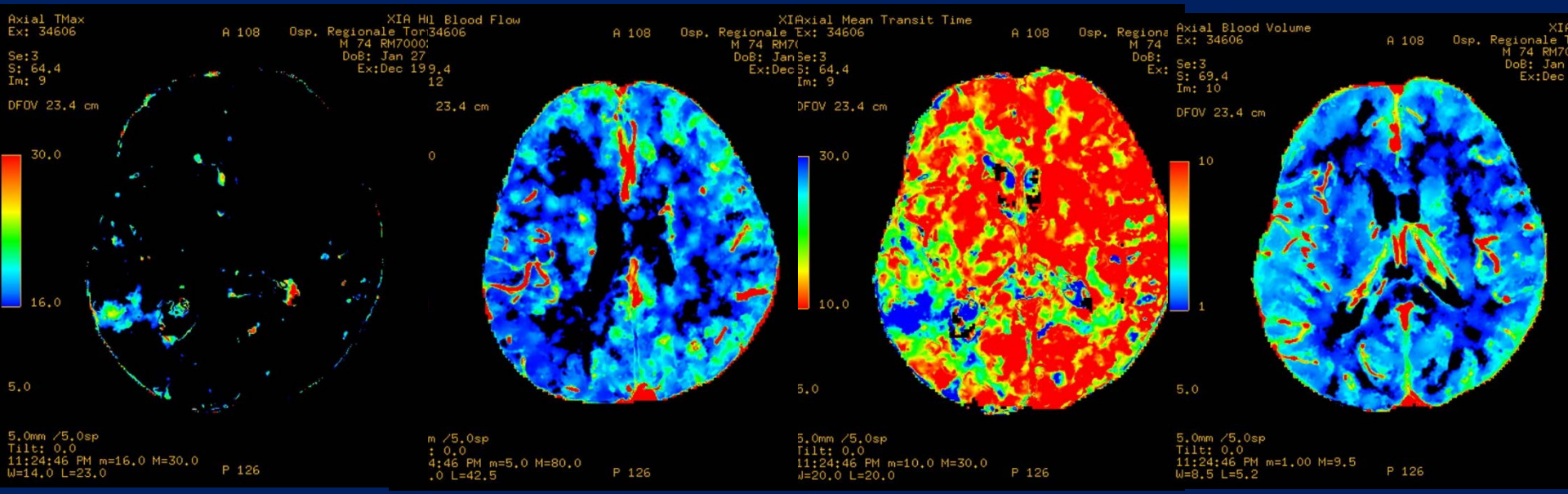
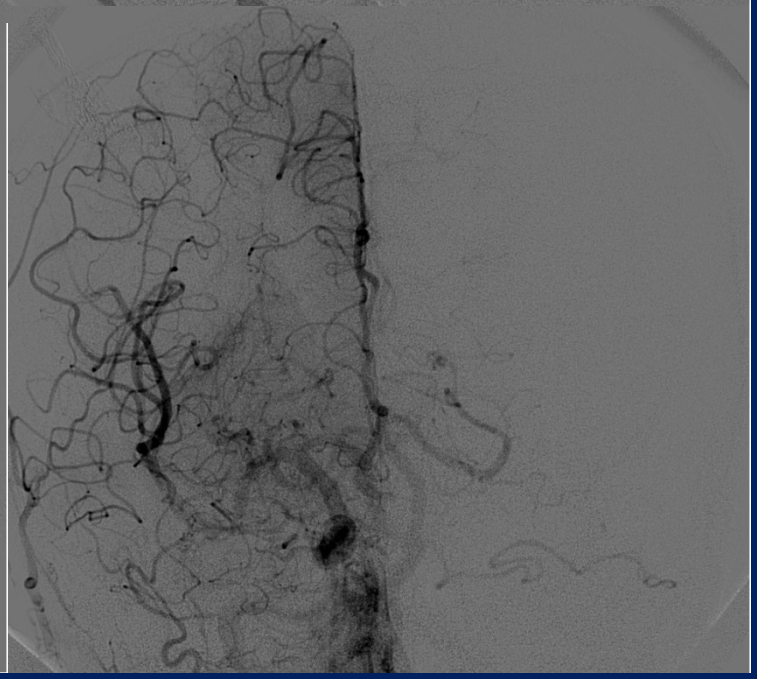






- Il paziente quando arriva in sala angiografica diventa soporoso.



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erativa cerebrale
2022
n Benedetto del Tronto (AP)


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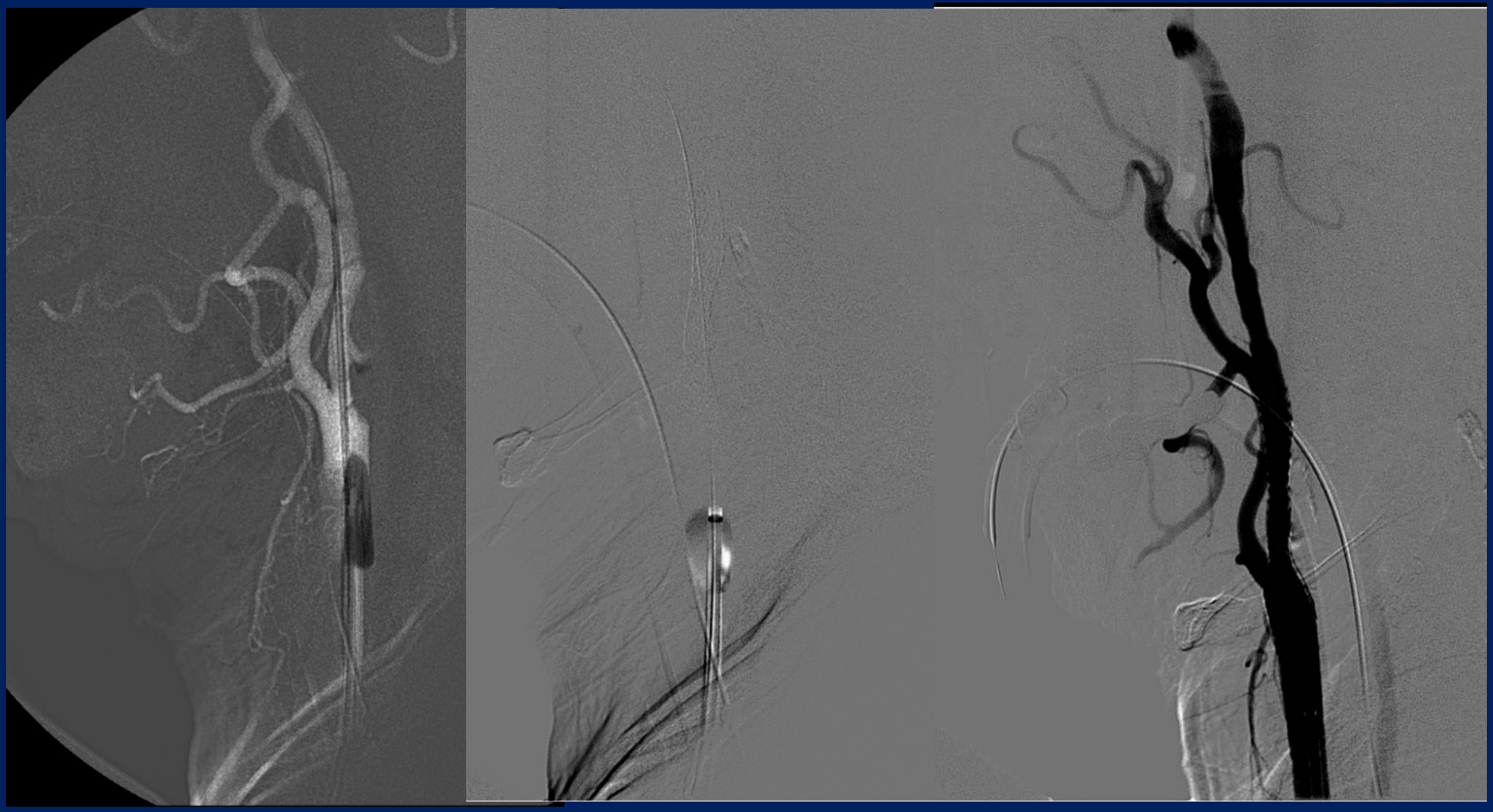


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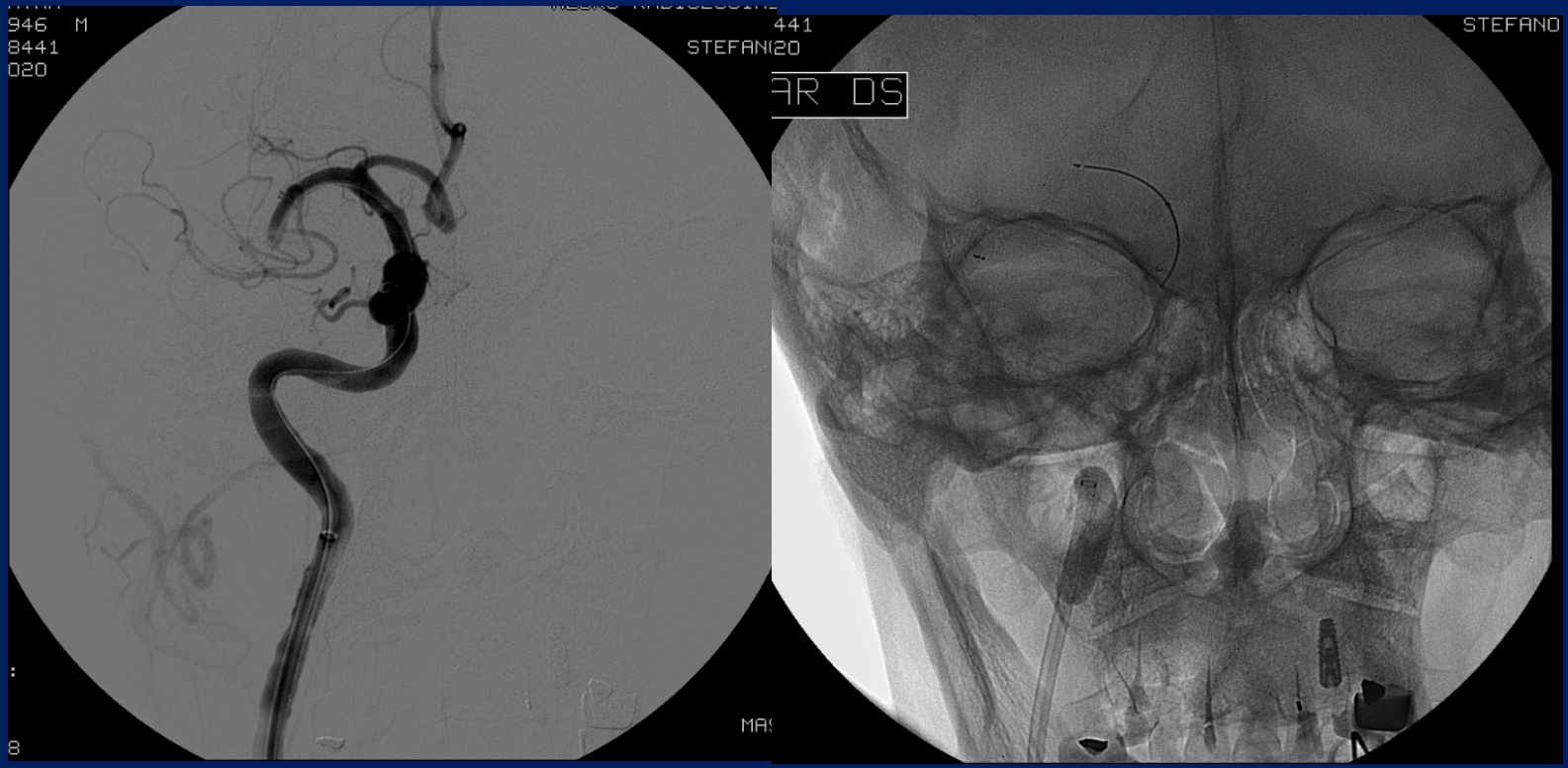
946 M
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STEFANO
AR DS


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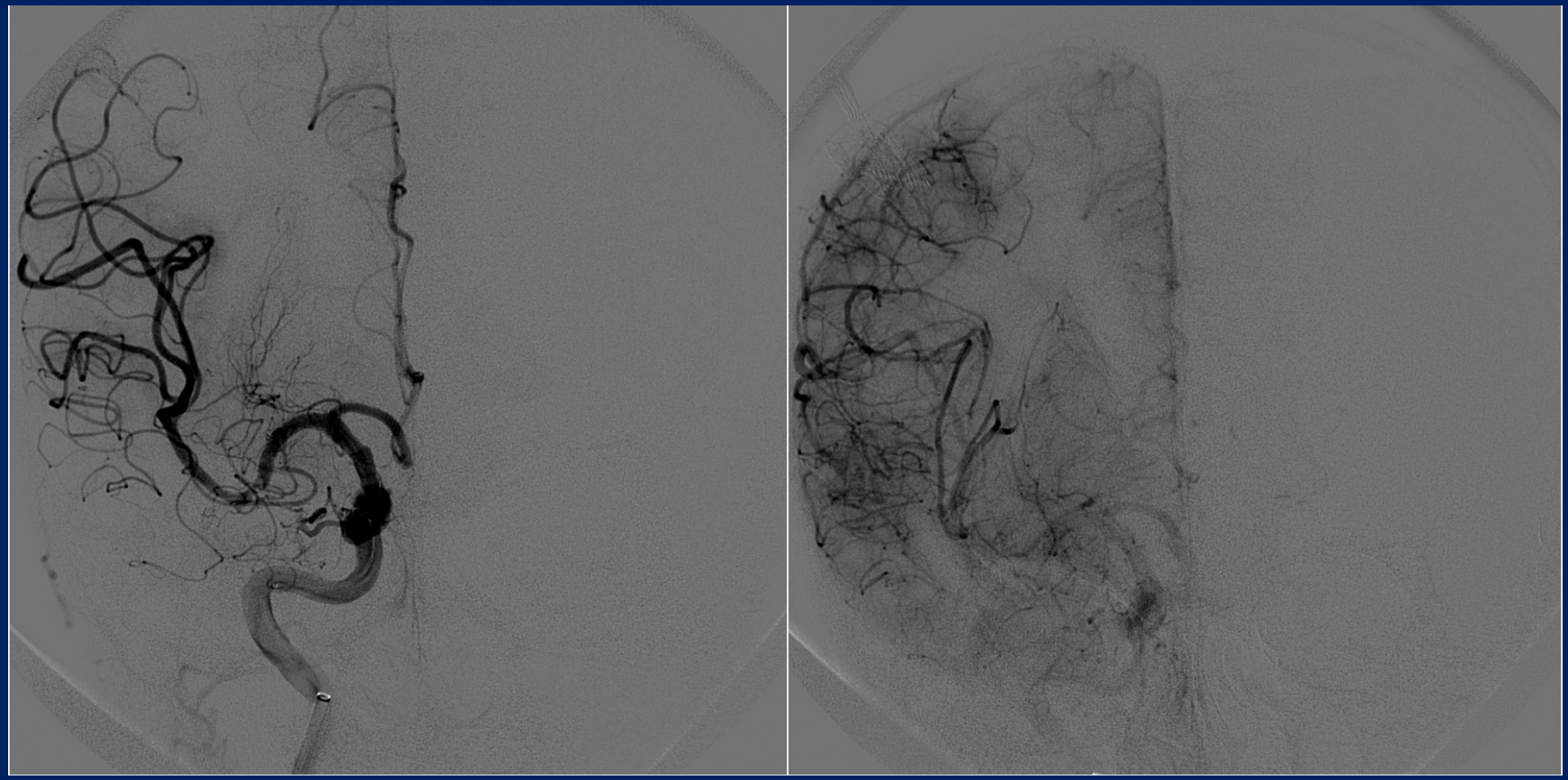


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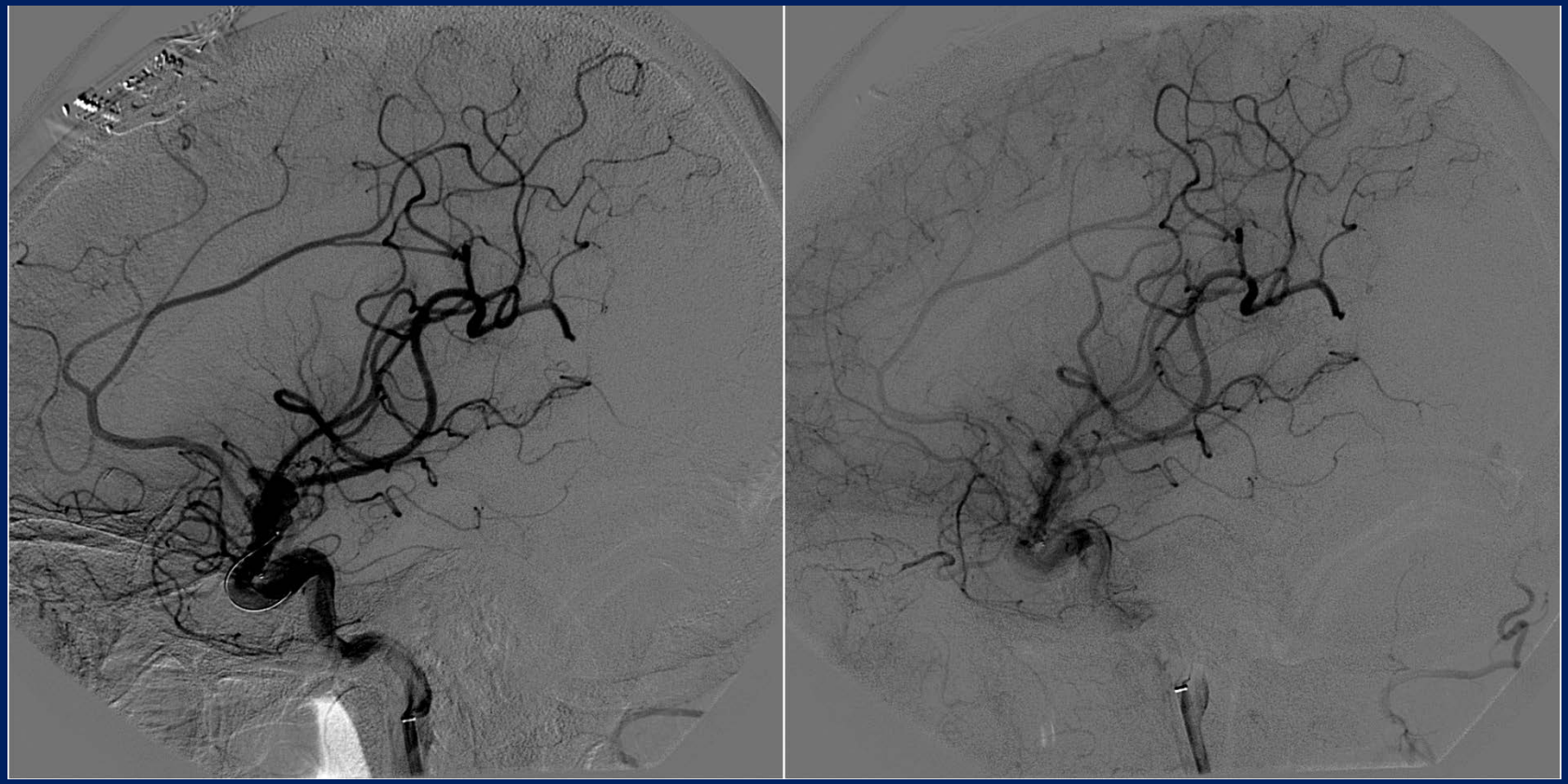


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- Il paziente a 4 gg ha un Nihss di 1-2 (barriera linguistica)

Nihss 11


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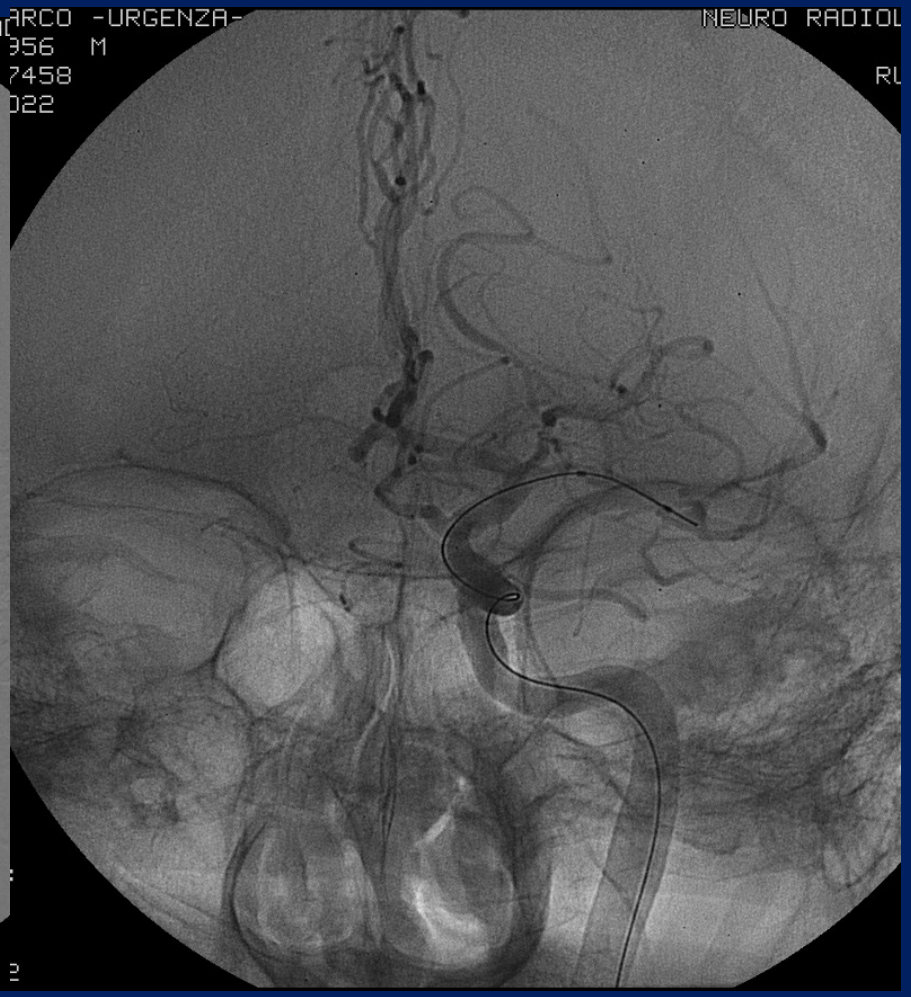
ARCO -URGENZA-
956 M
7458
022


ARCO -URGENZA-
956 M
7458
022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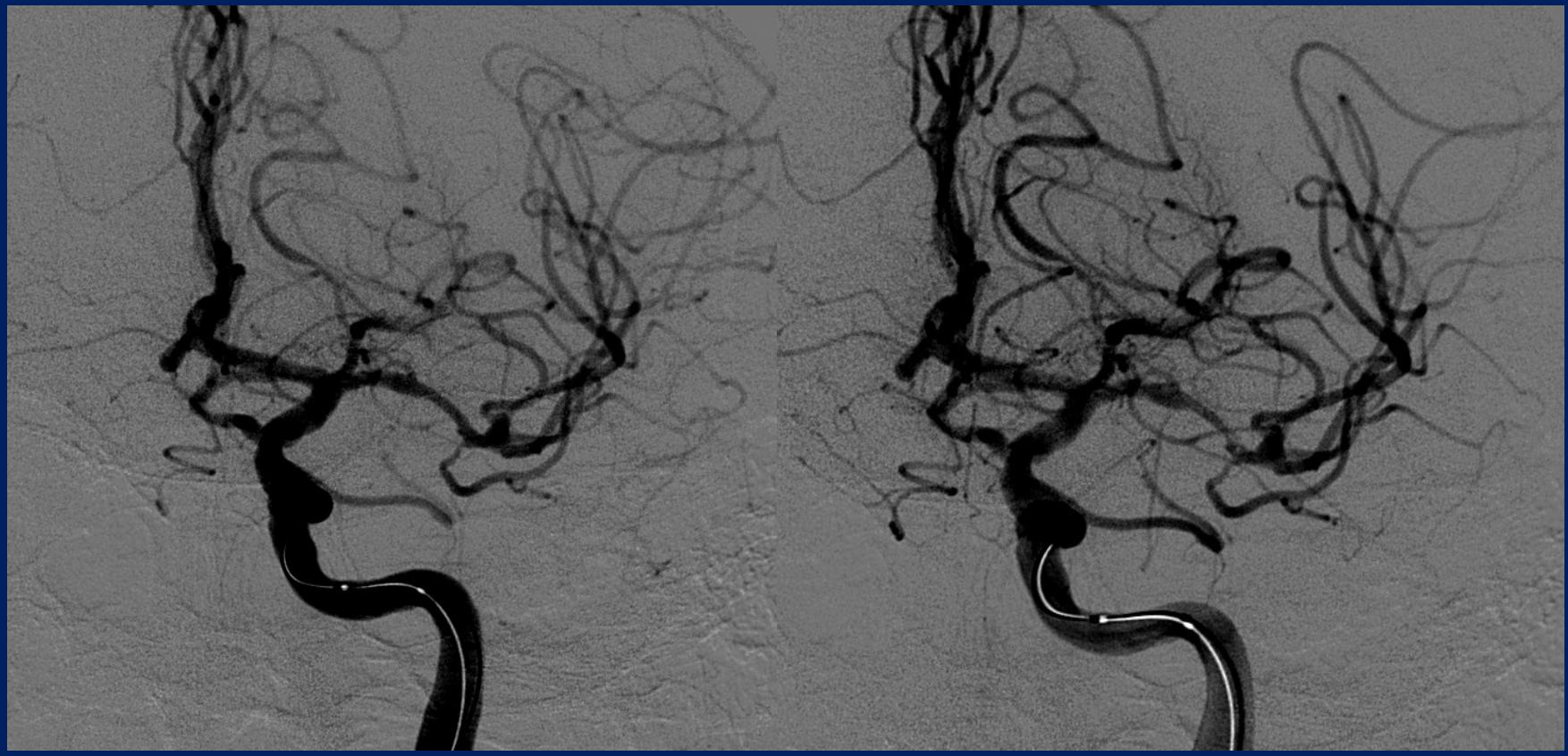


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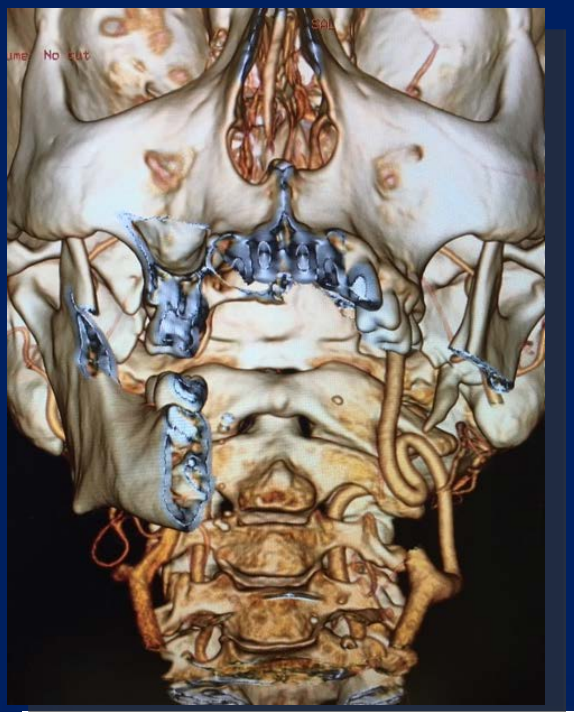
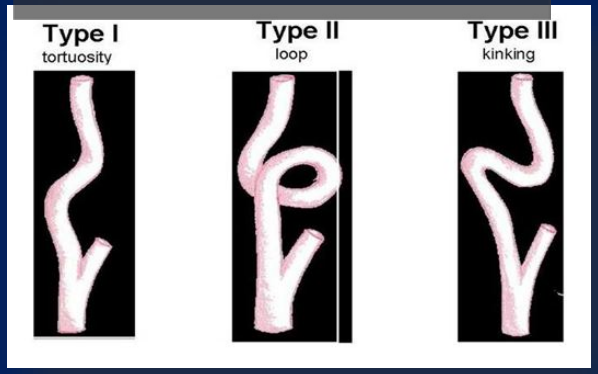
Criticità




Type I
tortuosity
Type II
loop
Type III
kinking

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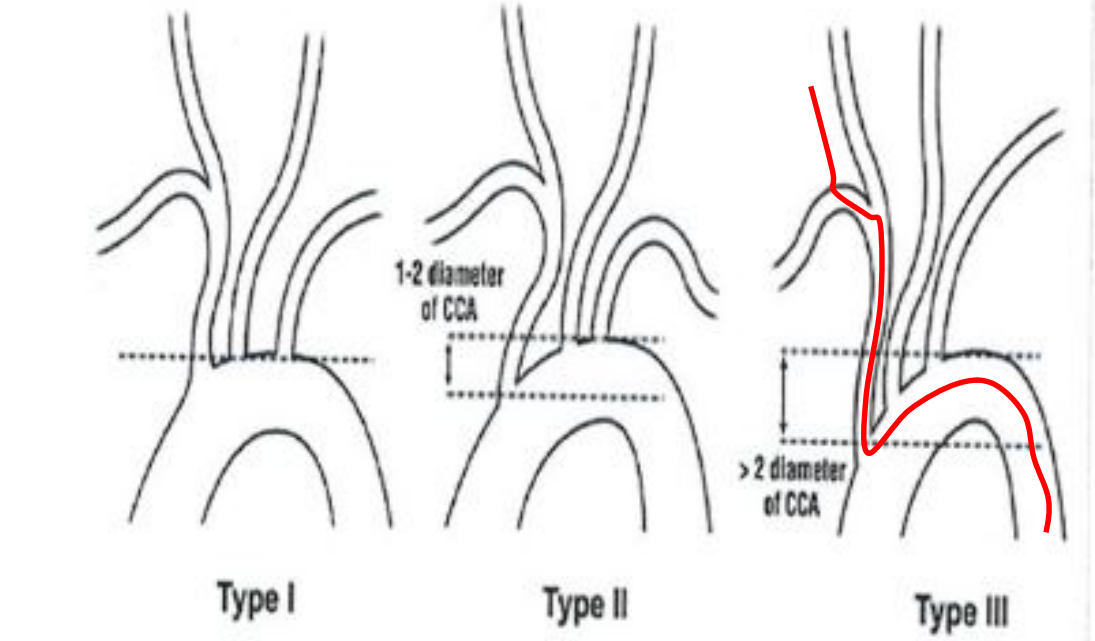

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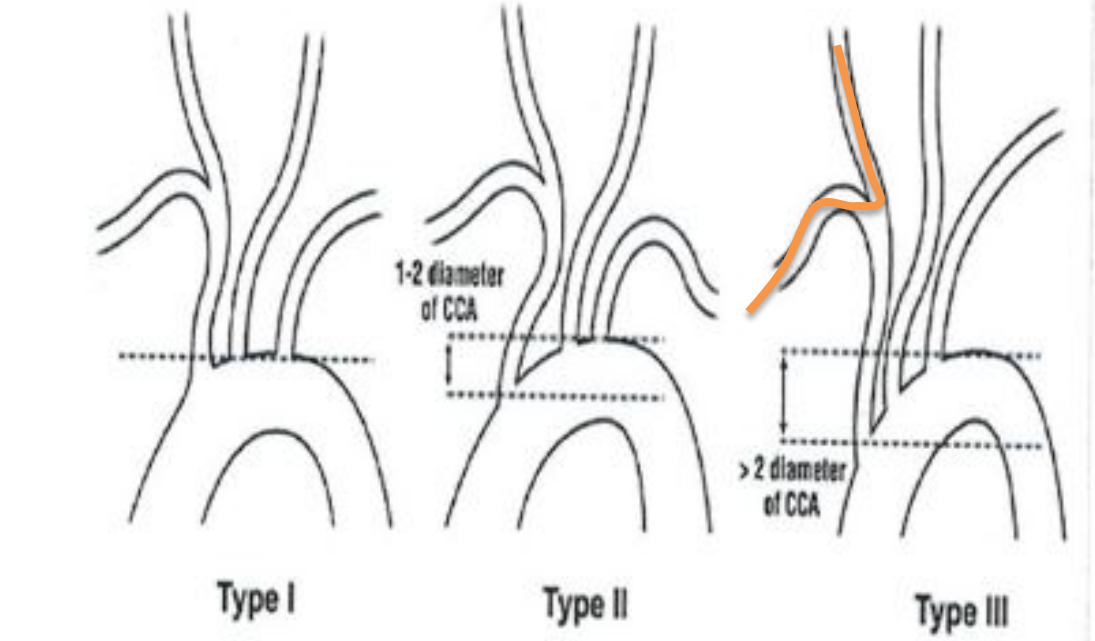

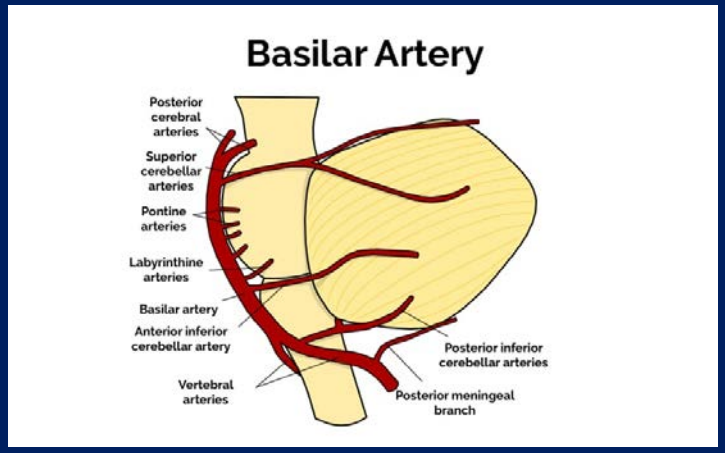

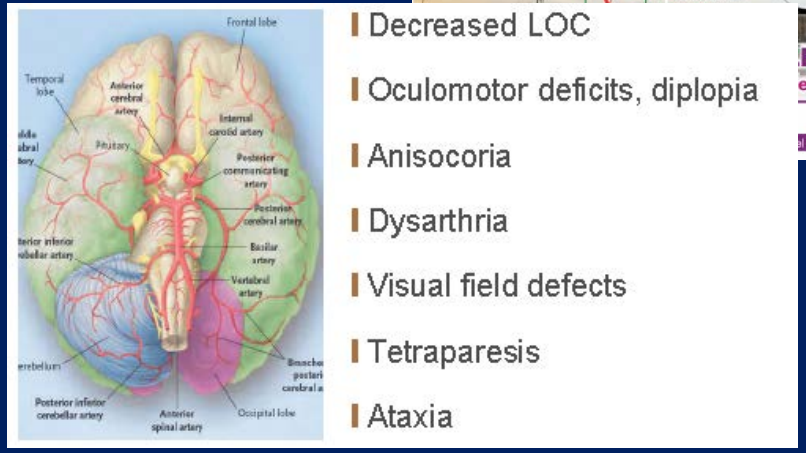

- Stroke del circolo posteriore 20 -25% di tutti gli stroke. BAO 1-4% di tutti gli stroke
- Spesso sintomi non focali
- Variabilità di insorgenza dei sintomi: Acuti, acuti con sintomi prodromici (vertigine, confusione, ecc.), progressivi e incostanti simulanti altri quadri clinici)
- Eziologia: Cardio embolica (40%-55%); Atero trombotica in situ (25%-35%); Steno dissecazione vertebrale emboligena (10%-30%)

- Uomo del 1945

- Stroke arteria basilare.


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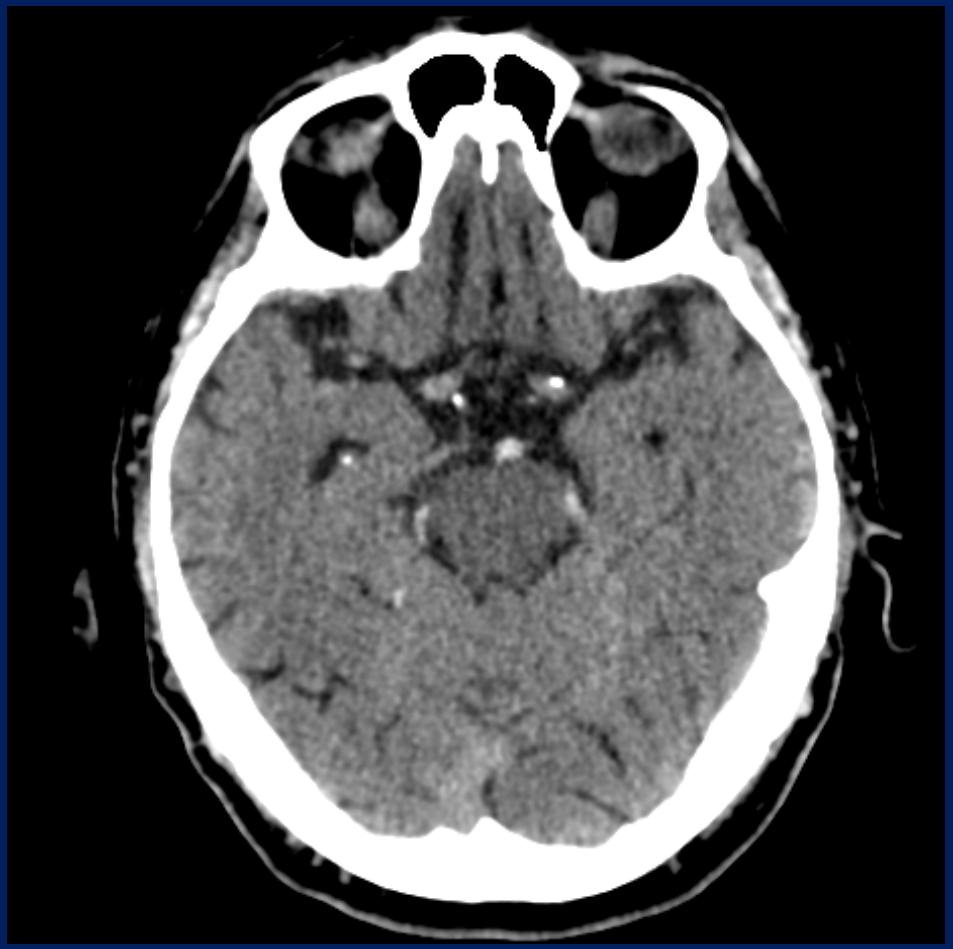

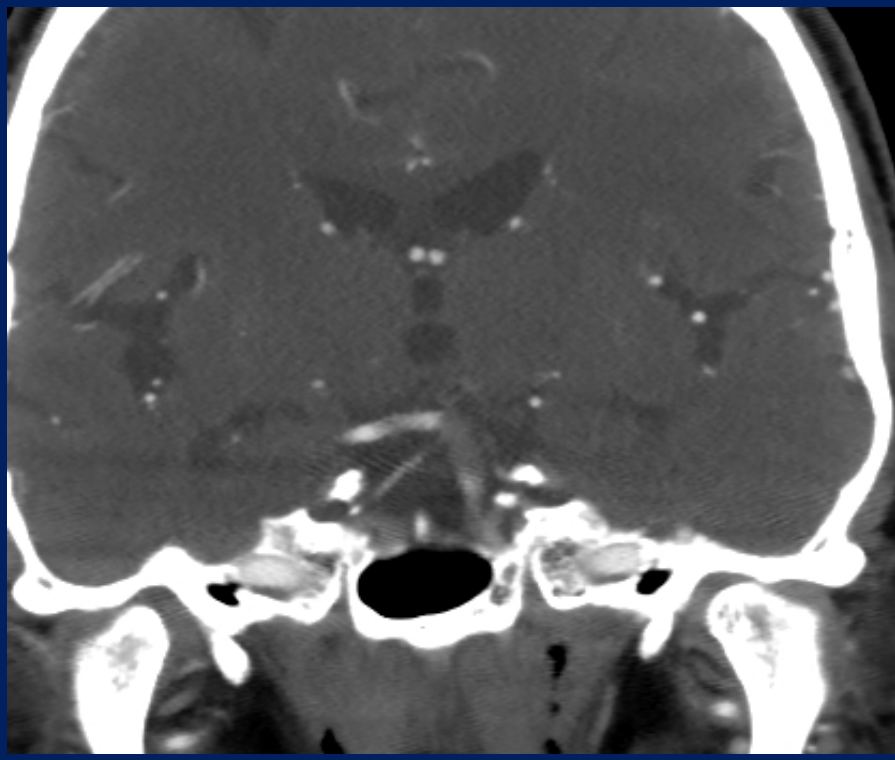

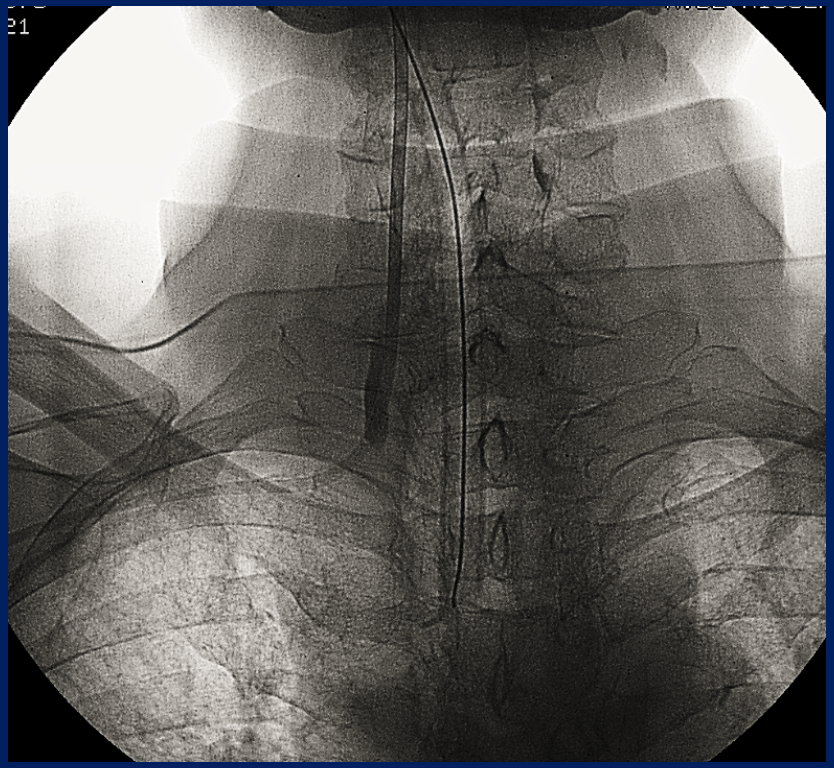

- La trombectomia è stata eseguita mediante accesso brachiale destro.


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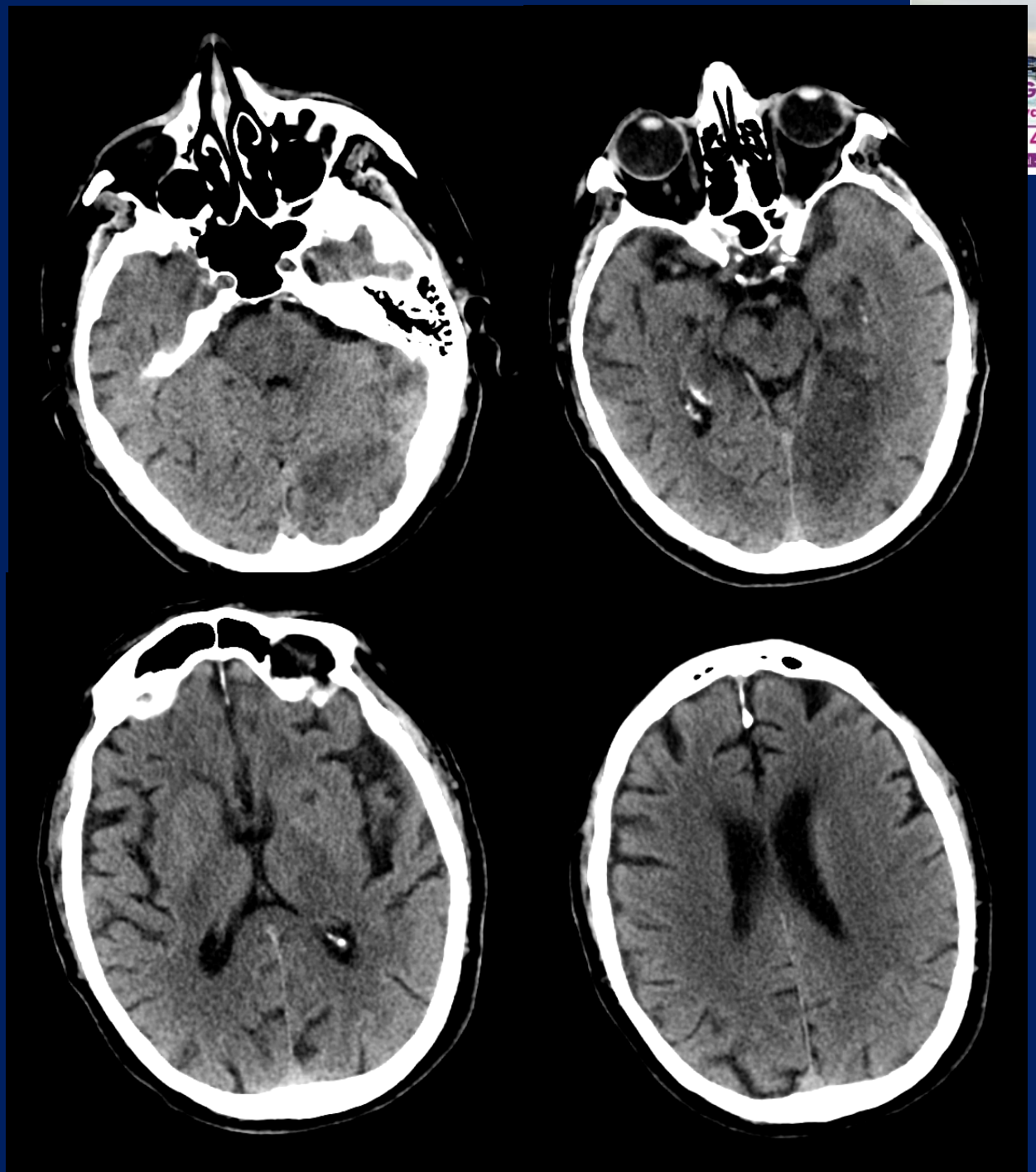

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Paziente del 1962
Stroke circolo posteriore


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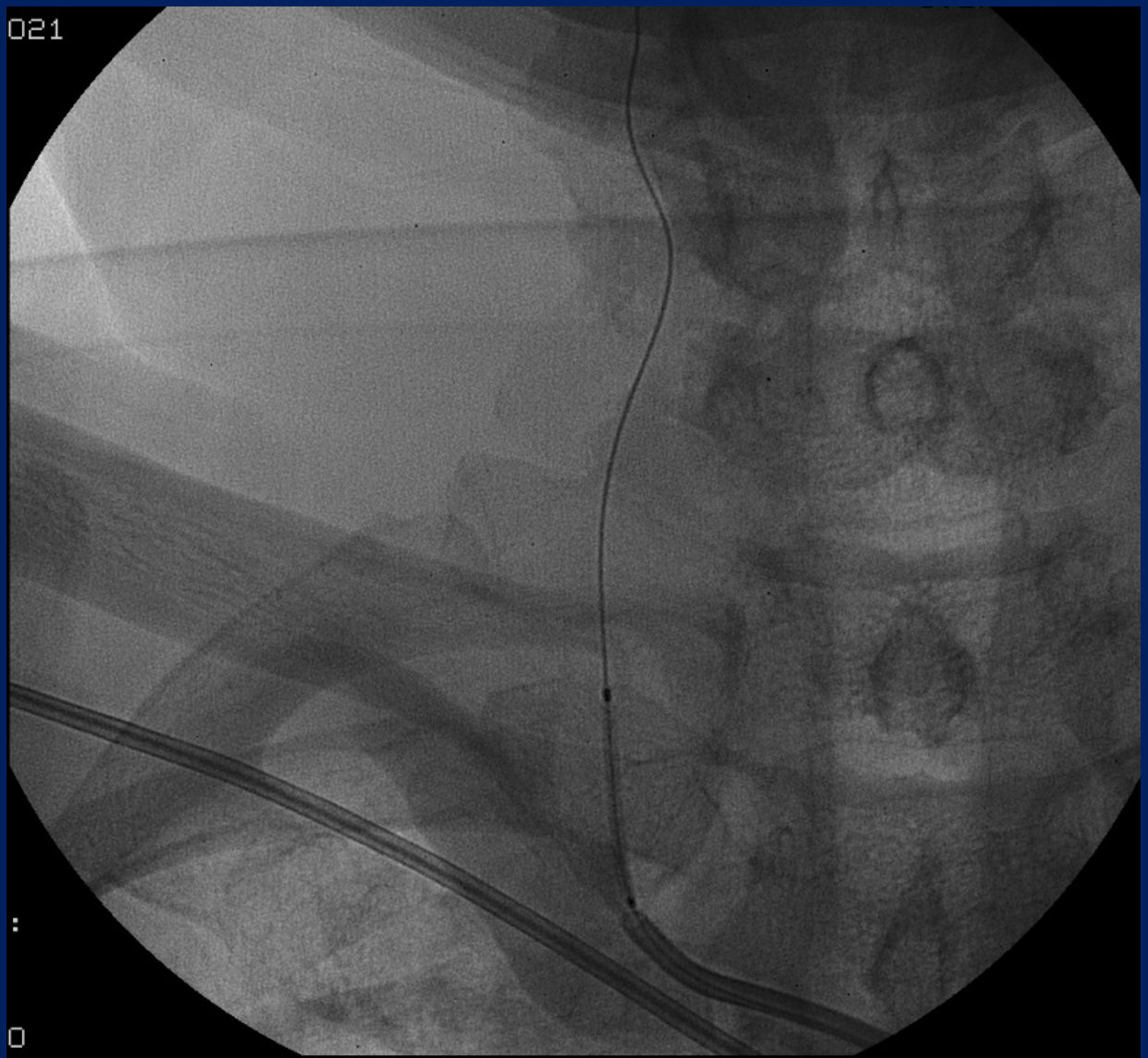
021


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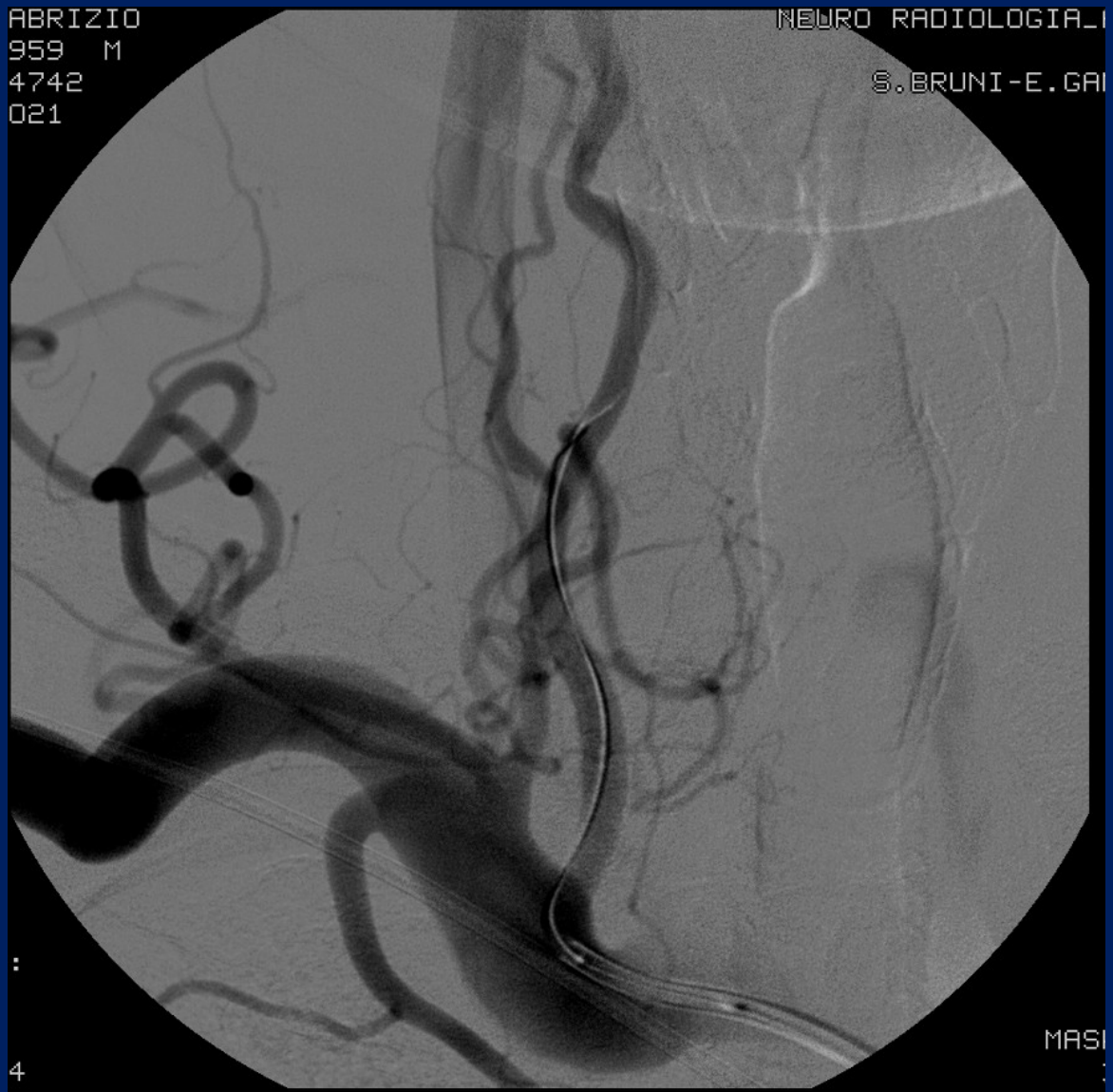
ABRIZIO
959 M
4742
021
NEURO RADIOLOGIA_I
S.BRUNI-E.GAI
MASI
4

Ragazzo di 40 anni

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Dopo 3 ore

- Il paziente va in coma.


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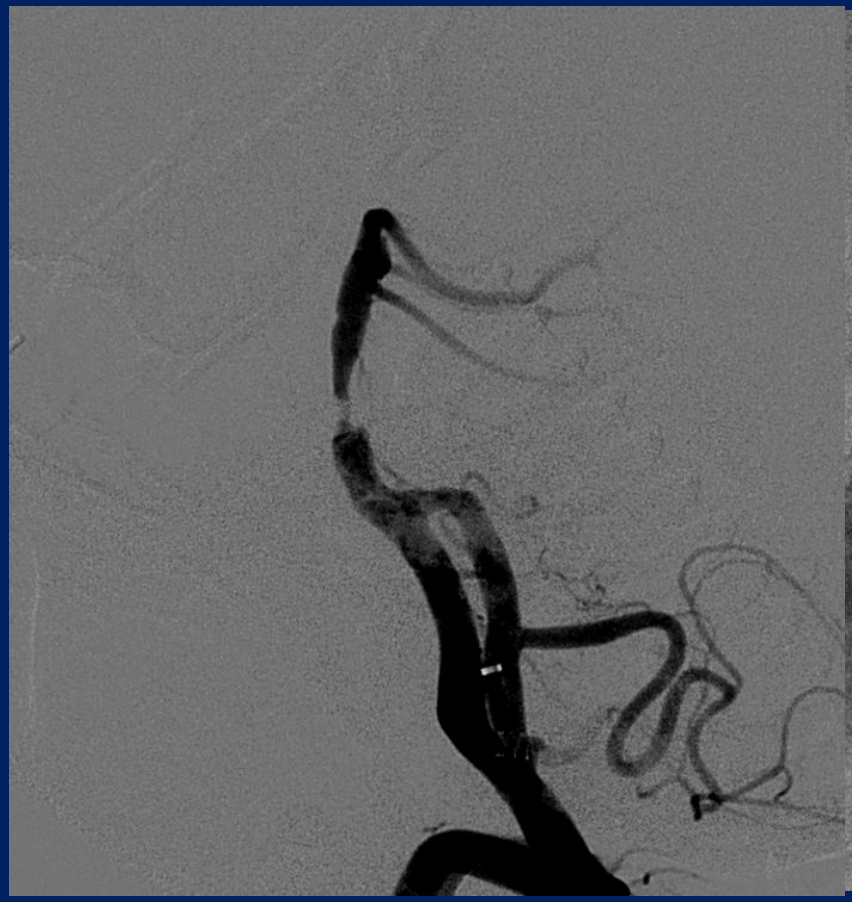

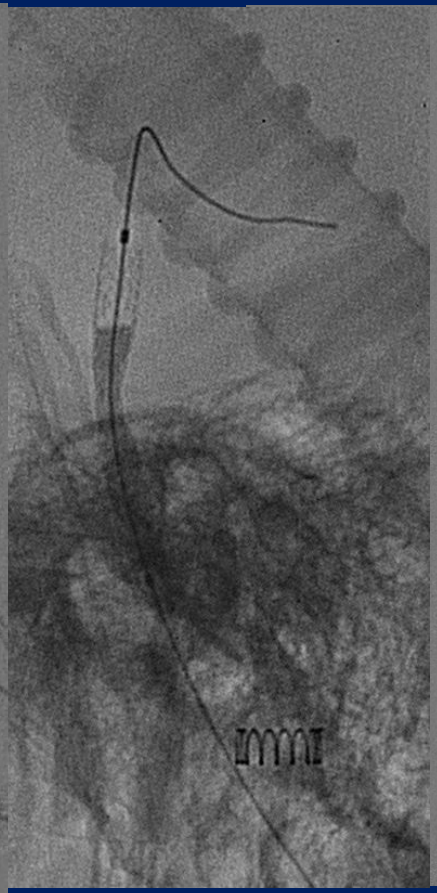


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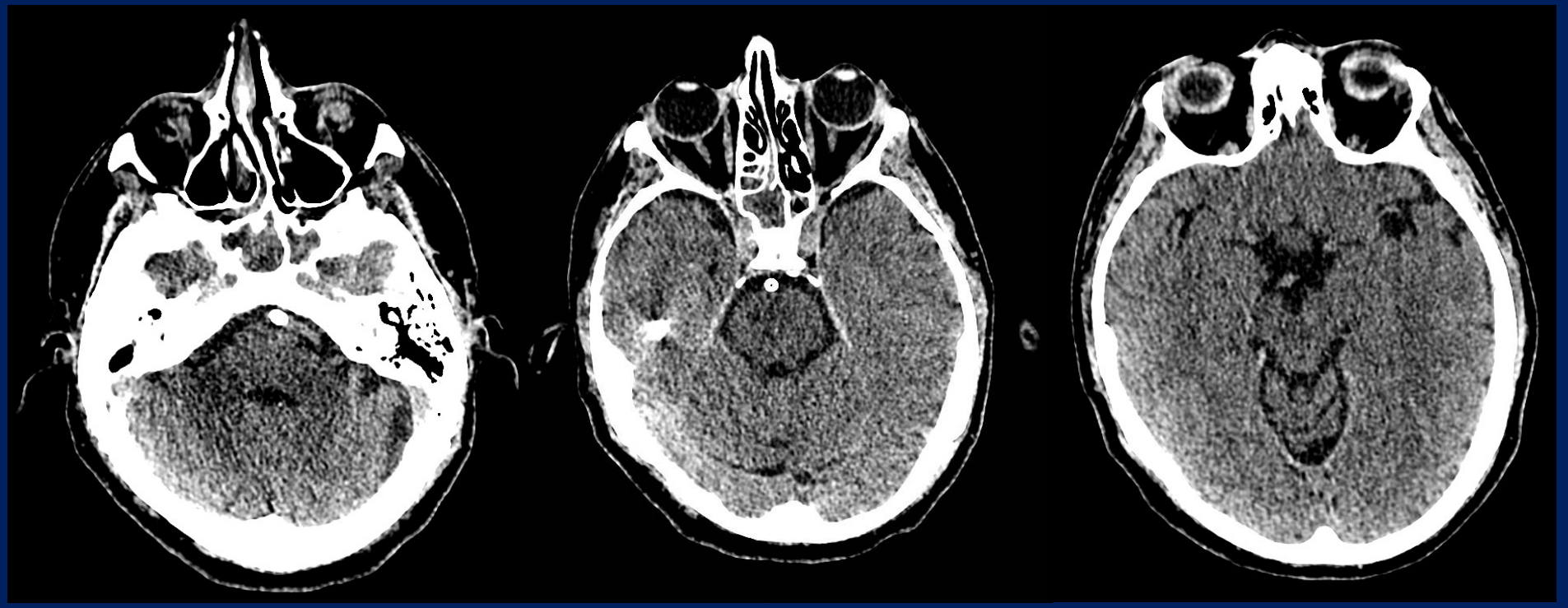
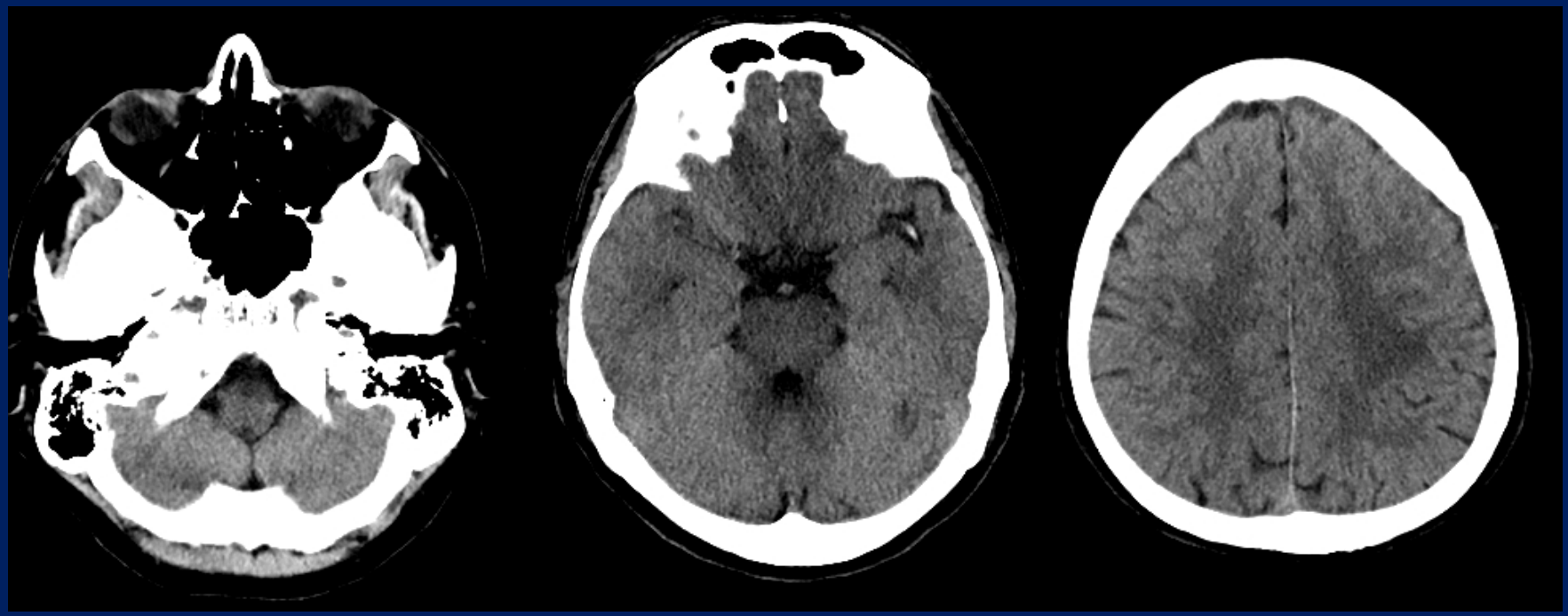


Paziente di 50 anni
Nihss di 6



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- Esegue fibrinolisi
- Dopo circa 30 minuti di fibrinolisi il paziente diventa Nihss 12-13
- Decidiamo di eseguire la trombectomia


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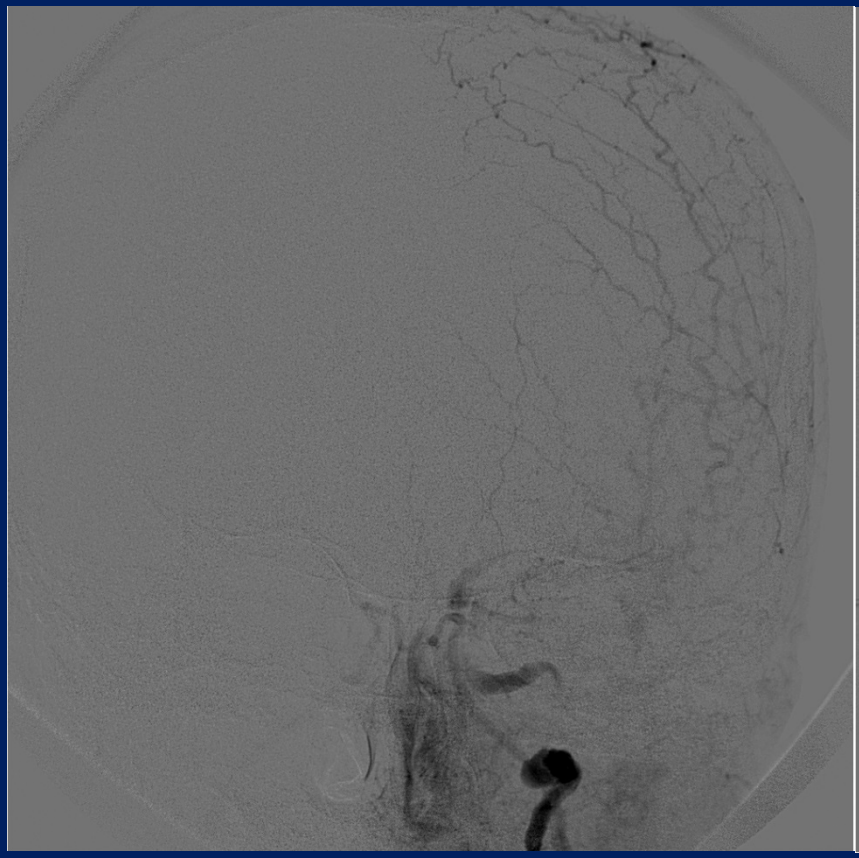

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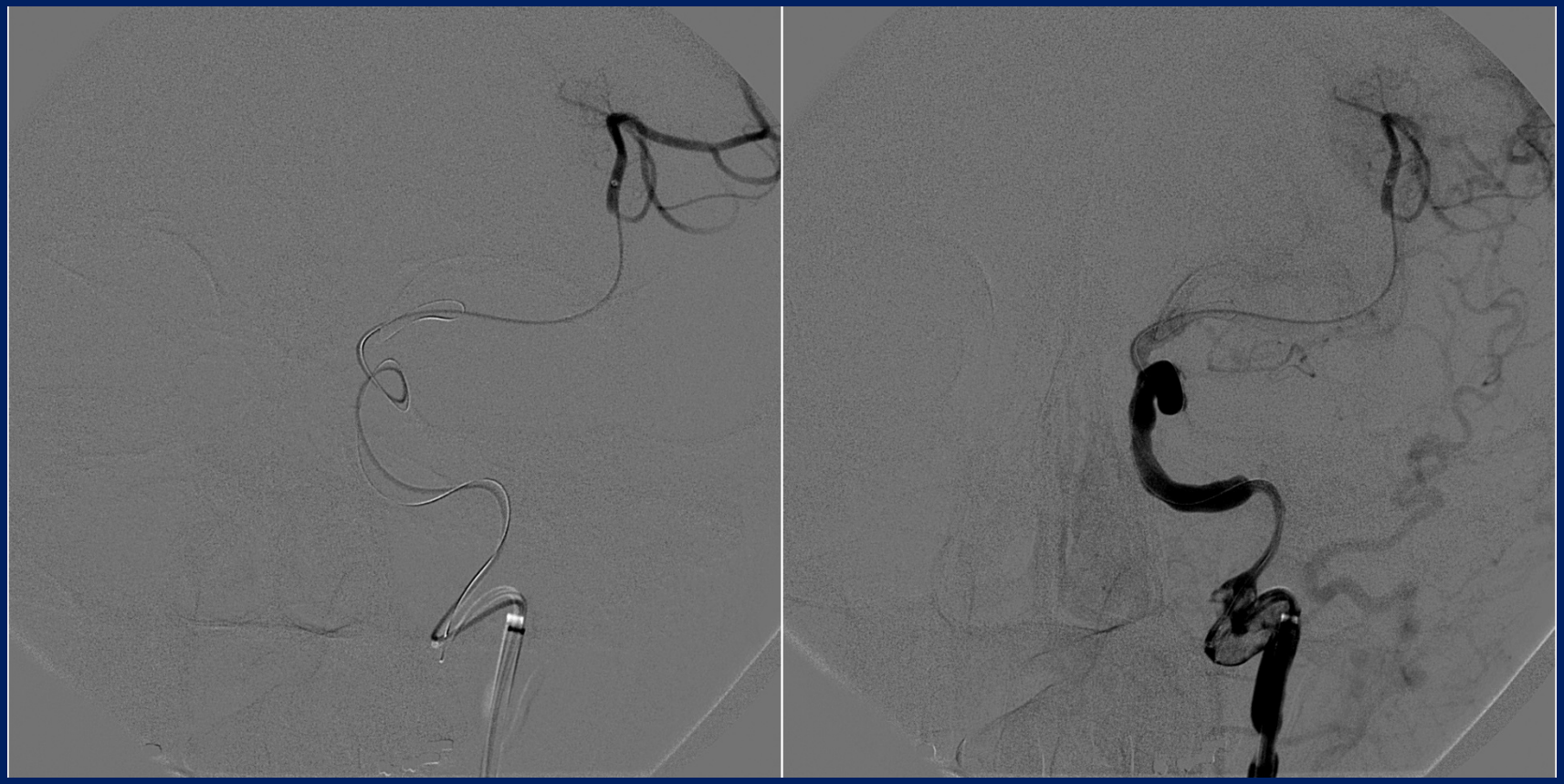


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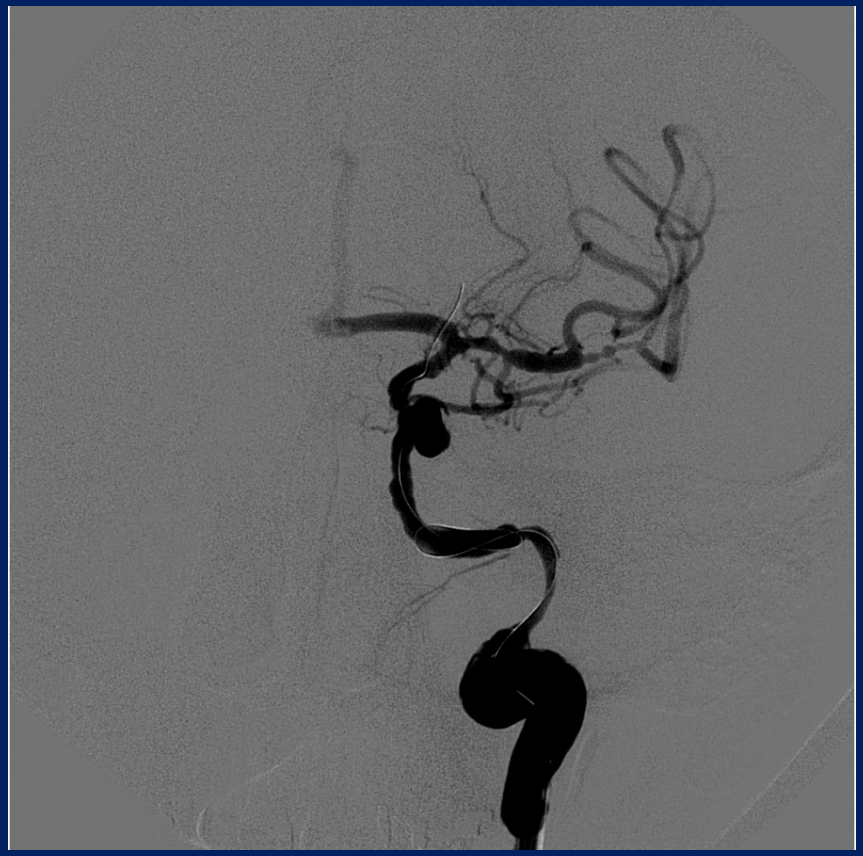


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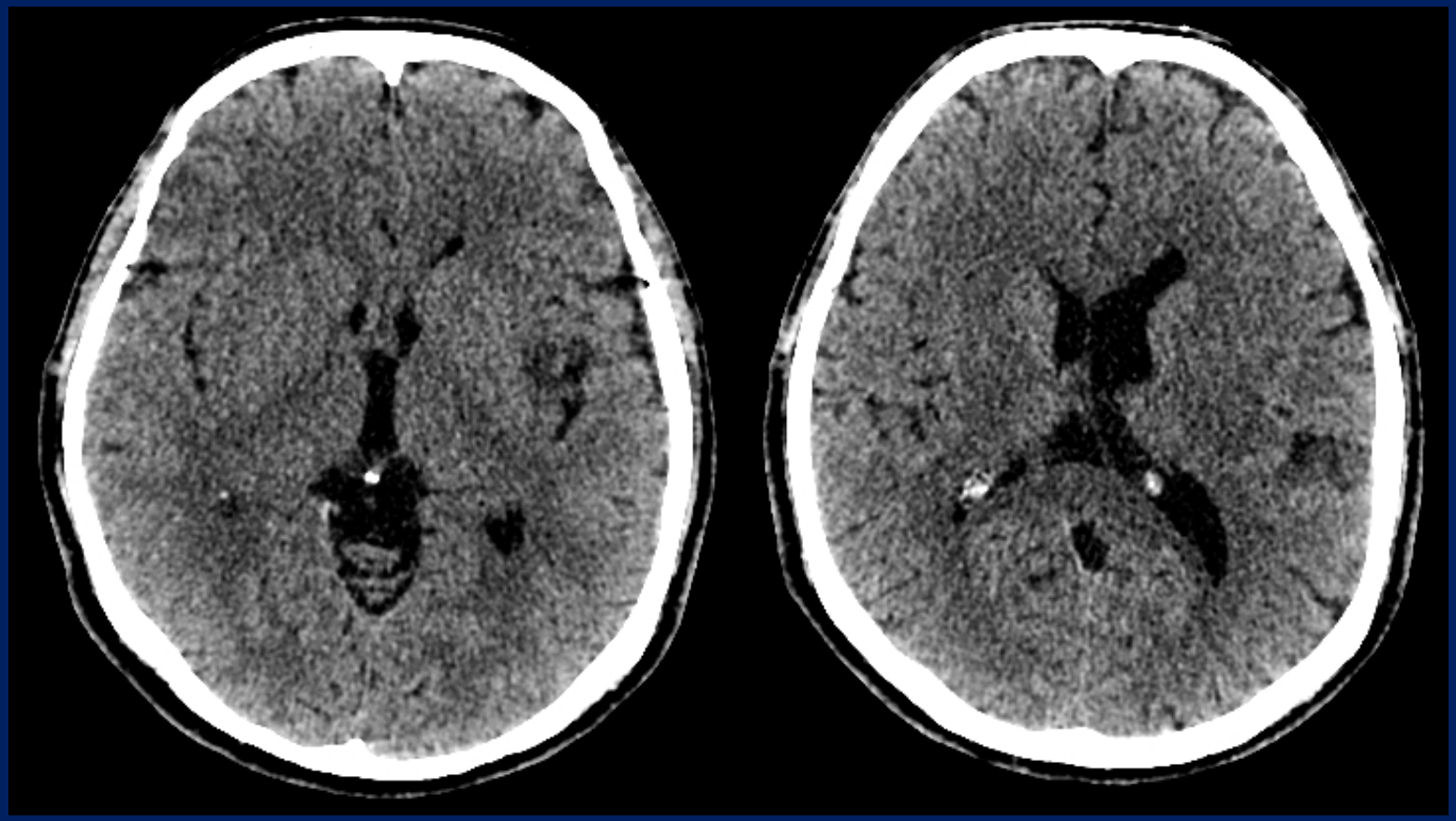

Terapia medica

- Flectadol durante il posizionamento dello stent carotideo o intracranico in acuto
- Reopro durante il posizionamento dello

  Stent
- Nei due giorni successivi carico di 4 plavix 75 mg e 600 mg di cardioaspirina
- E poi dal terzo giorni cardioaspirina 100mg e plavix 75 mg

Follow up diagnostico

- TC di controllo a 24 ore

- Nei pazienti sottoposti a stent carotidei o stent intracranici in acuto vengono eseguiti controlli con angio tc a 3 mesi

CONCLUSIONI

Le immagini del paziente con stroke devono essere complete:
Tc basale
angio Tc trifasica
e tc perfusione (quando il caso è dubbio , ICTUS a risveglio o comunque quando sono passate le 5-6 ore)

Il contatto tra centro spoke ed hub deve essere il più veloce possibile.

CONCLUSIONI

- Il neuroradiologo interventista deve poter visualizzare le immagini rapidamente

- Il paziente deve poter arrivare nel tempo più breve possibile con pressione arteriosa sistolica adeguata all'evento stroke (150-160 mm hg)

- Le procedura viene eseguita in sala angiografica con personale dedicato.


grazie per l'attenzione